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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

In the face of the enormous changes in force structure taking place as the Army downsizes to meet the requirements of a new security environment, our Chief of Staff has selected training and professional development as his highest priorities. General Sullivan is committed to "maintaining the edge" through these programs and to ensuring there are no more "Task Force Smiths" (an army unprepared to do its primary job of defeating an enemy on the battlefield.)

Fort Leonard Wood is fully engaged in General Sullivan's current efforts. To show our commitment, many of the articles in this issue of *ENGINEER* pertain to personnel and professional development initiatives. Our most important task at the moment is to ensure we get it right regarding new Army doctrine. Training and professional development programs must be placed in an overall doctrinal context if the pieces of these programs are not to appear disjointed or unrelated. Rest assured that combat engineers will have a key role in the future battlefield, whatever shape that battlefield takes in the evolving doctrine.

Attention now is focused more on filling the gaps in existing doctrine (e.g., peacetime engagements, war termination) than on wholesale changes to the basic battlefield construct in FM 100-5 (close, deep, and rear). Obviously, engineer opportunities abound in these areas. The 18th Engineer Brigade's mission in northern Iraq as part of Operation Provide Comfort (*ENGINEER*, October 1991, page 2) attests to that.

Speaking of opportunities, Brigadier General Joe Ballard, the Deputy Commandant, and Lieutenant General Bill Reno, DCSPER, recently reviewed key career management issues that affect our regiment. They include efforts to open more engineer slots to women. We are preparing the groundwork to open positions to women in all of the new divisional engineer brigade headquarters, bridge companies, and bridge headquarters. We are also developing a broad marketing strategy to increase the number of minority cadets who select engineer as their first branch of choice.

Noncommissioned officer (NCO) and junior enlisted career management challenges were outlined by Command Sergeant Major (CSM) Richard Wilson in the October 1991 *ENGINEER* magazine (page 61). Let me emphasize that MOS consolidation is an area both CSM Wilson and I are reviewing carefully. Sapper diversity must be a hallmark of the engineer force in the downsized environment in which future sappers will operate. Consequently, we are looking carefully at the pros and cons of combining sappers into one "CMF 12," as well as the advantages to be gained from combining vertical (51) and horizontal (62) MOSs. Be assured that we will not implement any changes in these areas in the next 12 months! We have spoken to many of you about the pitfalls of consolidation, and both CSM Wilson and I are determined to see the advantages of such a move clearly demonstrated before we implement any changes.

Finally, let me explain what we are doing within the Engineer School regarding curricula revisions to ensure we keep pace with the doctrinal changes. The Engineer Officers Advanced Course (EOAC) is being revised to establish a more focused block of instruction on sustainment engineering. Officers will receive instruction on required horizontal and vertical skills in modules that are scenario driven, to accentuate engineer roles in nation assistance and unit deployments and to set these roles in an overall strategic context. This change should emphasize the role sustainment engineering plays in both war and peacetime engagements.

Exciting times! Know you're taxed with day-to-day sapper demands, but don't forget the importance of self-development. *ENGINEER* magazine will include book reviews of relevant professional reading material—in this issue, the book review is on page 20. Take time to whet your appetite with the books in this and future reviews. The complex world we face demands that we deepen our professional competence and resolve. ESSAYONS!

Engineer

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The Engineer Personnel Proponency Office Works for You

"You can shape the future, if you can envision the future; that is the heart of proponency."

General Maxwell Thurman
CG, TRADOC
January 1989

In this period of steadily diminishing resources, the proponency business is ever-growing in importance. The commandant of the Engineer School, Major General Daniel W. Christman, is the branch proponent for engineer doctrine, engineer material, force structure, training, and personnel.

That last area of responsibility is the domain of your Engineer Personnel Proponency Office (EPPO), the Engineer School staff element responsible to the commandant for a wide range of engineer personnel matters.

Army Regulation 600-3, *The Army Personnel Proponent System*, is the EPPO "bible." It designates personnel proponents, assigns their basic responsibilities, and defines the eight personnel life-cycle management functions.

The objectives of the personnel proponent system are:

- Identify a single agent (proponent) responsible for all personnel matters in each career field.

By Lieutenant Colonel R. O. Buck

- Fix responsibility for all career field-related matters.
- Ensure that the civilian workforce is integrated into the personnel proponent system.
- Ensure that personnel management policies and programs established by HQDA incorporate career field-related considerations.
- Foster awareness and achievement of the objectives of the Officer Personnel Management System (OPMS), the Total Warrant Officer System (TWOS), the Enlisted Personnel Management System (EPMS), and the Civilian Integration into the Personnel Proponency System (CIPPS).

Satisfying these five objectives is a constant challenge for EPPO. The personnel business is, by its very nature, quite fluid in the best of times. As we proceed through a period of increased turbulence, heightened frustrations, and growing uncertainty, meeting and realizing these five objectives is all the more challenging and important.

The framework for our work in EPPO consists of eight life-cycle management functions: structure, acquisition, individual training and education, distribution, deployment, sustainment, professional development, and separation. A brief review of each of these functions will, I believe, permit a better appreciation of the diversity and complexity of the personnel management arena, as well as highlight some of the key ongoing personnel issues we engineers collectively face today.

Structure

Much of our effort is devoted to analyzing and recommending modifications to the engineer personnel structure in light of documented and annotated changes projected through 1996 (and beyond, in some cases). This effort may be directed at tables of distribution and allowances (TDAs), tables of organizations and equipment (TOEs), individual career management fields (CMFs), or military occupation specialties (MOSs). In all cases, we strive to balance what makes sense for the Army and the engineer force while ensuring adequate career progression within each MOS and CMF.

Presently, we are studying, along with the rest of the Engineer School staff, the feasibility of consolidating military occupational specialties 12B, 12C, and 12F into one MOS, 12A, or "sapper." This study involves a detailed look at changes in the progression patterns of the three MOSs versus the new single MOS; any additional training requirements that would evolve as a result of the consolidation; and the effect of such a consolidation on our ability to properly man the new Engineer Restructure Initiative (ERI) battalions and brigades. If such a consolidation is to take place, it will probably not occur before 2nd quarter, FY 94.

Other MOS consolidations in CMF 51 and CMF 81 are under study at the Engineer School. One such action, the "roll up" of three MOSs, 51G (Materials Quality Specialist), 81B (Technical Drafting Specialist), and 82B (Construction Surveyor) into one MOS to be called 51T (Technical Engineer) appears to be almost a "natural." Study surveys have revealed a broad consensus in the field for such a move. This consolidation could occur as early as 3rd quarter, FY 94. Other consolidations may come later, as we continue to examine ways to streamline the personnel system, while maintaining good career progression and satisfying the Army's needs.

Acquisition

EPPO has an opportunity each year to provide recommendations to the Department of the Army concerning the quality of both enlisted personnel and officers being brought into the Corps of Engineers. In the case of enlisted soldiers, EPPO annually provides Personnel Command (PERSCOM) a preferred mix of recruits in each engineer MOS, based on mental category. The DA-approved FY 92 enlisted accession plan reflects both the branch desires and the efforts of DA to bring in top-quality soldiers. No more than 3 percent of our 12B, 12C and 12F enlistees may be of the lowest acceptable mental category (CAT IV). Even smaller numbers of CAT IV soldiers are permitted in other engineer accession specialties.

Additionally, as the result of a recent comprehensive Army review (in which EPPO participated) of the engineer enlisted specialties, we have initiated a study of MOS accession qualification scores. We expect this study to lead to an increase in some scores so that only the brightest individuals become the engineer soldiers of the future.

In the officers' arena, we annually provide to PERSCOM our desired mix of academic specialties for graduating ROTC cadets about to be assigned a branch. Not surprisingly, the Corps of Engineers strives to acquire as many new second lieutenants with "hard" (engineering and science-oriented) college degrees as possible. Leadership ability (as demonstrated at ROTC advanced summer camp) is an important attribute too, so we also accept top-notch new officers with other academic backgrounds who have strong summer camp scores.

Our continuing desire to access the best commissioned officers from ROTC, the United States Military Academy and the Officer Candidate School (OCS) has launched EPPO into a major marketing undertaking called "Selling the Branch." In the next year, we will publish a series of updated pamphlets, produce a number of promotional items such as bumper stickers and coffee cups, and distribute a series of video tapes which will highlight for the officer-to-be the benefits of serving as an engineer officer. Hand-in-hand with producing and distributing these products will be the development of a site visitation program which will find representatives of the Engineer School visiting selected ROTC detachments to discuss first-hand the challenges and benefits of the Corps of Engineers.

Accession of warrant officers continues to be of interest to EPPO. All packets submitted from the field for application into engineer warrant officer MOSs are first reviewed by the EPPO staff to ensure they are complete and meet basic eligibility criteria. Each acceptable packet is then forwarded to USAREC for board action.

Individual Training and Education

The schooling and training of the engineer force is vital to our collective and individual futures. A principle item of interest to EPPO is advanced civil schooling for engineer officers. Many engineer officer positions require graduate degrees (typically a master's degree). To satisfy this need, 40 to 60 officers are sent to graduate school each year. The majority pursue a master's degree in civil engineering and engineering management at a wide variety of schools, and with significantly varying costs to the Army.

EPPO has undertaken a long-range study to identify those graduate schools which charge reasonable tuition (typically in-state rates) and offer programs of instruction easily adaptable to our officers' needs, regardless of their undergraduate academic backgrounds. Hand-in-hand with this, we are also developing a data base of suitable environmental

engineering programs. This is in recognition of the Corps' growing role in protecting the environment and repairing facilities the Army will close in the next five years.

In the warrant officer arena, TRADOC recently directed the transfer of proponency for MOS 213A (Engineer Equipment Repair Technician) from the Engineer School to the Ordnance School. A memorandum of understanding between the two proponents was recently completed which calls for this action to be finished by July 1993.

One of our main concerns is to ensure that the certification and senior 213A training courses remain viable and effective during and after the transition period. Indeed, one fall-out of this transfer of proponency is that both programs of instruction (POIs) may actually be expanded and strengthened—for the betterment of future 213A warrant officers.

On the enlisted side of the house, the standing lists for attending our basic noncommissioned officer course (BNCOC) and advanced noncommissioned officer course (ANCOC) are currently being examined to determine if engineer soldiers are having to wait unacceptably long periods of time to attend either of these courses. Remedies, if needed, might include expanding class size or increasing the frequency of classes.

Distribution

This function gets EPPO close to the assignments business—not on an individual-by-individual basis (that's the job of the assignments branch at PERSCOM)—but rather on an aggregate basis. In this day and age of often-changing personnel policies, EPPO is periodically called upon to provide recommendations regarding assignment practices, individual and unit stabilization policies, branch and MOS transfer programs, and other policies affecting the distribution of engineer soldiers.

Presently, Army force reductions are proceeding at a rate much greater than our personnel reductions. As a result, several engineer enlisted MOSs will be significantly overstrength by the end of FY 92, and, in some cases, beyond. This fact is not unique to engineers; many MOSs in the Army will be in the same situation. In our case, the MOSs projected to be significantly oversubscribed are 12B, 51B, 51K, 62H and 62J. Because of these excesses, many engineer units will be at 125 percent or more in selected MOSs for some time to come. It will take a couple of years for a number of realignment actions, ranging from natural attrition and deliberate under-accessing to forced reclassification and DA-controlled reenlistment procedures to properly redistribute sufficient numbers of soldiers in overstrength MOSs to balance the engineer force. In all cases, no action will be taken without ample advance notice to the field.

Of interest to many of our company grade officers is the designation of a functional area (FA) in the fifth year of service. The FA designation process is completed for all Year Group (YG) 86 officers (the results were scheduled for release by the time you read this). As the importance of certain FAs, such as 49 (Operation Research Systems Analysis), 54 (Operations, Plans, and Training) and 97 (Procurement) grows, engineer representation in such FAs becomes more essential. Thus, more and more engineer officers will be assigned FAs. Over time, we will move from an engineer officer force with a single-tracked (ST) (holding only an engineer specialty) to FA ratio of 60:40 to a force more distinctly FA-oriented. The target ratio for YG 86 is 50:50 and the long-range aggregate target ratio is 40:60.

Another important distribution consideration, for both officers and enlisted personnel, is the quantity and quality of interchangeable positions (those which may be filled by either male or female soldiers) in the engineer force structure. In terms of quantity, we want to provide female engineer soldiers with sufficient interchangeable assignments to ensure proper opportunity for career progression. Quality means providing our female engineers with challenging, professionally-enhancing assignments—in a variety of units.

Female soldiers, both officer and enlisted, are an integral part of the engineer force. Additional engineer MOSs are opening up to them, with the position of diver (00B) being the most recent example. EPPO is presently exploring the appropriateness of opening up bridge company and other unit positions to women soldiers.

Deployment

With Operations Desert Shield and Desert Storm successfully completed, a myriad of lessons learned are currently being recorded and analyzed. One critical area in which EPPO is particularly interested is the effect of the mobilization process on the personnel system (and visa versa, for that matter). The turbulence created within the personnel system by the deployment to Southwest Asia was truly far-reaching. Our collective ability to document those procedures which worked the best will make future deployments more efficient and less disruptive.

A relatively unique kind of "deployment," the permanent movement of units due to the restationing of a number of engineer battalions being realigned under ERI, is presently underway. This undertaking, too, is causing turmoil within the engineer personnel system (both for those who wear the uniform and their families). Recording lessons learned and those procedures which "work the best" may prove invaluable during future iterations of the Army's drawdown.

Sustainment

As the drawdown progresses, EPPO's role in sustainment of the engineer force will assume ever-increasing importance. Our greatest staff responsibility in this arena is establishing and maintaining communications with engineer soldiers. This edition of *ENGINEER* represents such an effort. Our interest in the communication arena includes providing factual updates to the field, suppressing rumors, and fostering a positive attitude toward the personnel system and its programs.

In the enlisted arena, EPPO is also participating in the evaluation of continuation, reenlistment, and retention rates in engineer career fields. At this writing, DA has announced a revision of reenlistment control points (RCPs) applicable to all soldiers in selected grades across the entire force. We monitor the officer arena in a similar fashion, recommending criteria for the retention and rebranching of officers under the conditional voluntary indefinite program.

For both enlisted soldiers and officers, EPPO is involved in briefing DA-centralized promotion selection boards. In the case of senior enlisted (SFC, MSG, and SGM) promotion boards, an EPPO representative briefs the board members on issues pertinent to the Corps of Engineers. EPPO provides similar input to PERSCOM for inclusion in briefings to DA officer promotion boards.

Another important aspect of sustainment is maintaining the health and welfare of the civilian workforce. As the proponent for the Wage Grade 77 career field (Facilities Operations and Maintenance), the Corps of Engineers is responsible for ensuring the proper representation and sustainment of this important and diverse group of government employees. EPPO has the lead in coordinating this effort.

Professional Development

Of the eight life-cycle management functions, professional development ranks high on EPPO's list of priorities. Indeed, it is the umbrella function, for if the first six life-cycle functions are properly executed, sound and effective professional development is fostered.

We are presently updating the Enlisted Professional Development Guide, which provides engineer soldiers with a single-source professional development document. Similarly, EPPO is preparing to participate in the DA-level updating of DA PAM 600-3, Officer Professional Development—the updated version (a publication date has not yet been set by DA) will establish more detailed professional development goals for all officers, in recognition of the fact that many officers do not follow the traditional "command track."

While on the subject of professional development, allow me to put in a "plug" for duty at the Engineer School. From the standpoint of broadening one's professional knowledge, and simultaneously having a hand in ensuring the future of the Corps of Engineers, I can't think of a better place to spend a tour of duty. Teaching our up-and-coming noncommissioned officers and commissioned officers presents daily challenges, leaves one with a tremendous sense of self satisfaction, and provides instructors the opportunity to fine-tune skills and expand horizons.

One particular program that is truly rich in professional development opportunities is Project Warrior. Officers and noncommissioned officers enrolled in this program work as observer/controllers at the National or Joint Readiness Training Center for two years. They then transfer to the Engineer School for an additional two years where they instruct future engineer leaders. A super program by any measure, Project Warrior is open to branch-qualified captains, along with E-7 NCOs who have served as successful platoon sergeants. Call your PERSCOM assignment officer or the EPPO staff for details.

Separation

The eighth and final life-cycle management function is the one we generally prefer not to think about too much: separation from the service. However, given the Army's drawdown, this function is presently one of the most critical of the life-cycle management process. The EPPO staff continues to be involved in evaluating proposed changes to retirement policies and separation procedures.

"As the build-down proceeds...tough decisions have already been made...and more will surely follow."

As the build-down proceeds and external pressure builds to reduce the Army force structure further (below a force of 535,000), the EPPO staff will almost certainly be engaged in evaluating a host of early-out options, changes to reenlistment procedures, and other force-reduction options. Some tough decisions have already been made at DA, and more will surely follow. The opinion of all the personnel proponents is often sought by DA and TRADOC, and final decisions regarding separation policies are not made without considerable deliberation.

In this article, we've taken a look at the objectives of the personnel proponency system and delved in some detail into the eight life-cycle personnel functions which receive much of EPPO's attention. At this point, you might ask "Just who are these folks in EPPO who are doing all this analysis, studying, researching, and recommending?"

Well, it's a relatively small staff—there's just 15 of us. Eleven of us wear the Army uniform, and between us, we represent all the engineer career management fields (interestingly enough, one of us is an infantryman—assigned, undoubtedly, to keep our APFT scores at a high level!). None has a "personnel background"—except myself. All are truly "of the troops and for the troops" (to borrow a phrase from the Military Police Corps). We are eager, willing to explore any possibility, and caring.

Our five civilian employees have, between them, more than 69 years of government service. The tremendous institutional knowledge and insight they possess collectively and individually are virtually indispensable to the functioning of our office.

The Engineer Personnel Proponency Office exists to serve you. If you have any questions, comments, or suggestions regarding engineer-related personnel issues, please call or write us. The personnel field is the focal point for many decisions being made relative to the Army's drawdown. The mission of EPPO is to serve as your ombudsman, to represent your concerns, and to provide the engineer personnel perspective to the Department of the Army. Working together, we can shape the future.

Lieutenant Colonel Buck is chief of the Engineer School's Engineer Personnel Proponency Office. He previously served as commander of the 589th Engineer Battalion. Other assignments include Career Programs Officer and Lieutenant Colonel Assignments Officer at the Military Personnel Center. He was also executive officer of the 78th Engineer Battalion, and DEH operations officer in Karlsruhe, Germany. He is a graduate of the Armed Forces Staff College.

Clear the Way for Civilian Proponency

By Cynthia Mathews

In 1987, the Army Chief of Staff approved the recommendation of the Civilian Personnel Modernization Project to integrate civilian employees into the Army Personnel Proponent System. As a result, the Deputy Chief of Staff for Personnel (DCSPER) directed the implementation of the Civilian Integration into the Personnel Proponency System (CIPPS).

CIPPS was introduced in a three-phase program. Phase I grouped all civilian occupational series by career fields and designated a proponent for each field. Military occupational skills (MOS) were used as the basis for this proponent assignment. This effort resulted in 59 distinct career fields to be managed by 35 proponent offices. Twenty-four of these offices are co-located with their military proponency counterparts and 11 are civilian unique proponencies. During Phase II, 14 volunteer proponencies established pilot programs to test the roles and responsibilities of civilian proponency.

We are now in Phase III, which culminates the proponency initiative of the Civilian Personnel Modernization Project. Final revisions of AR 600-3, *The Army Personnel Proponent System*, are now being made and civilian proponency offices are being activated Army-wide.

At the Engineer School, the Civilian Proponency Branch is part of the Engineer Personnel Proponency Office. Joint efforts on behalf of military and civilian personnel in the engineering field will provide economy of operations and consistency in professional development. CIPPS will add cohesion to the engineer work force by affirming the total Army principle of one integrated force while promoting greater understanding of both military and civilian systems.

Career Field 77 - Facilities Operations and Maintenance

Series	Title
WG 2801	Miscellaneous Electrical Installation and Maintenance
WG 2805	Electrician
WG 2810	Electrician (High Voltage)
WG 2854	Electrical Equipment Repairing
WG 3501	Miscellaneous Manual Labor
WG 3502	Laboring
WG 3508	Pipeline Working
WG 3566	Custodial Working
WG 3601	Miscellaneous Masonry, Plastering & Roofing
WG 3602	Cement Finishing
WG 3603	Masonry
WG 3604	Tile Setting
WG 3605	Plastering
WG 3606	Roofing
WG 3609	Floor Covering Installing
WG 3610	Insulating
WG 3611	Glazing
WG 3653	Asphalt Working
WG 3806	Sheet Metal Mechanic
WG 3807	Structural/Ornamental Iron Working
WG 3808	Boilermaking
WG 3818	Spring Making
WG 4101	Miscellaneous Painting & Paperhanging
WG 4102	Painting
WG 4103	Paperhanging
WG 4104	Sign Painting
WG 4201	Miscellaneous Pipefitting
WG 4204	Pipefitting
WG 4206	Plumbing
WG 4601	Miscellaneous Woodworking
WG 4604	Wood Working
WG 4605	Wood Crafting
WG 4607	Carpentry
WG 4618	Wood Working Machine Operating
WG 4639	Timber Working
WG 4741	General Equipment Operating
WG 4742	Utility Systems Repairing Operating
WG 4749	Maintenance Mechanic
WG 5001	Miscellaneous Agricultural, Forestry & Kindred Operations
WG 5002	Farming
WG 5003	Gardening
WG 5026	Pest Controlling
WG 5042	Tree Trimming and Removing
WG 5306	Air Conditioning Equipment Mechanic
WG 5309	Heating and Boiler Plant Equipment Mechanic
WG 5313	Elevator Mechanic
WG 5318	Lock and Dam Repair
WG 5324	Powerhouse Equipment Repairing
WG 5326	Drawbridge Repairing
WG 5401	Misc Fixed Industrial Equipment Operation
WG 5402	Boiler Plant Operating
WG 5403	Incinerator Operating
WG 5406	Utility Systems Operating
WG 5407	Electric Power Controlling
WG 5408	Waste Water Treatment Operating
WG 5409	Water Treatment Plant Operating
WG 5413	Fuel Distribution System Operating
WG 5415	Air Conditioning Equipment Operating
WG 5419	Stationary — Engine Operating
WG 5426	Lock and Dam Operating
WG 5430	Drawbridge Operating
WG 5433	Gas Generating Plant Operating
WG 5438	Elevator Operating
WG 5479	Dredging Equipment Operating
WG 5706	Road Sweeper Operating
WG 5716	Engineering Equipment Operating
WG 5725	Crane Operating
WG 5729	Drill Rig Operating
WG 5731	Mining/Tunneling Machine Operating
WG 6903	Coal Unloader Operating

The commandant of the Engineer School is the proponent for Career Field 77, "Facilities Operations and Maintenance." We are the advocate for all civilian personnel who hold the engineer wage grade occupational job series and titles shown at left. Engineer positions are categorized under 13 different trade and labor job families. Engineer employees hold positions in the following 13 trade and labor job families:

Electrical Installation and Maintenance
General Services and Support Work
Structural and Finishing Work
Metal Working
Painting and Paperhanging
Plumbing and Pipefitting
Wood Work
General Maintenance and Operations Work
Plant and Animal Work
Industrial Equipment Maintenance
Industrial Equipment Operation
Transportation/Mobile Equipment Operation
Warehousing and Stock Handling

About 31,000 wage grade employees fall under the auspices of the engineer civilian proponency. These employees are assigned to every Army major command and almost every geographic location where the Army serves. Two-thirds of these employees are assigned to CONUS. Total numbers are depicted by CONUS regions on the next page. The remaining 10,000 employees are assigned OCONUS in Alaska, Belgium, England, Germany, Hawaii, Italy, Japan, Korea, and Panama. Career Field 77 employees are serviced by 155 Civilian Personnel Offices.

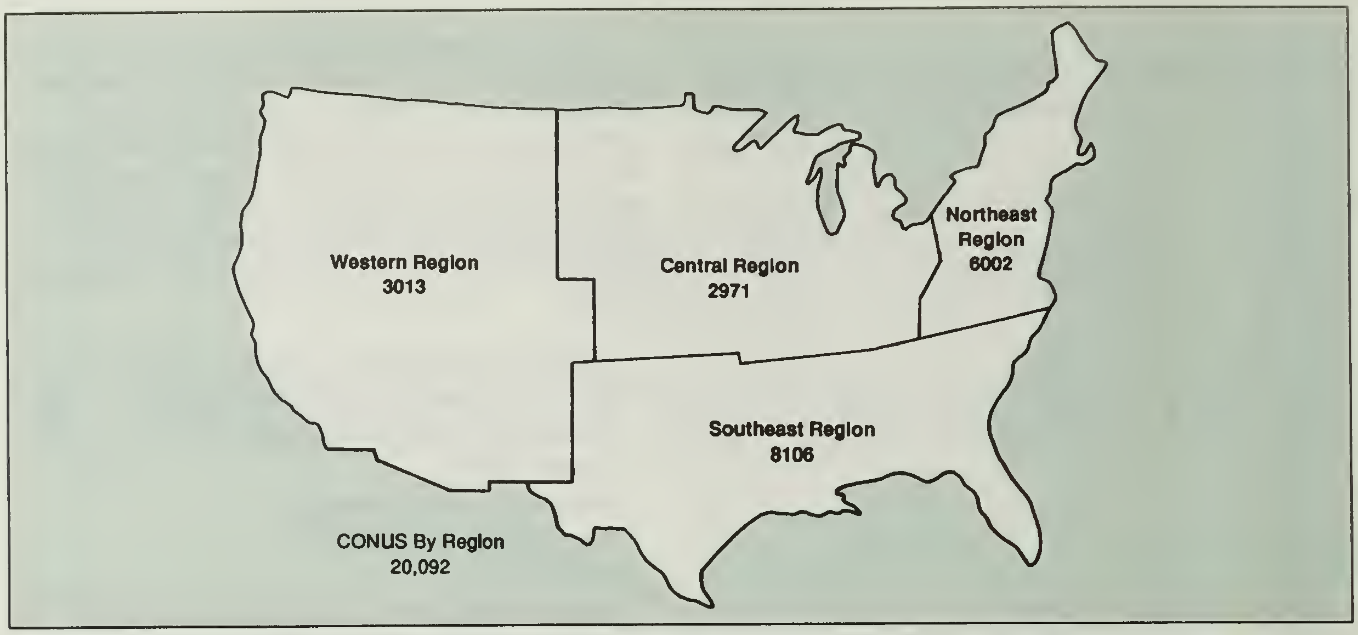
The Life Cycle Management Model has proven effective in the personnel administration of the military work force and will be equally effective for civilian personnel management. A synopsis of the civilian involvement in each of the seven life cycle management functions follows:

Structure

Recommend new, or changes to, classification standards.
Assist in developing standard job descriptions.
Establish career progression patterns.

Acquisition

Forecast recruitment needs.
Recommend recruitment sources and applicant evaluation criteria.
Develop affirmative action plans for acquiring employees.



Wage grade engineer employee population by CONUS region (as of 1 September 1991)

Training, Education And Professional Development

Develop training plans for each occupation in the career field.

Incorporate supervisory, managerial and leadership core requirements.

Determine the need for competitive development groups.

Distribution

Identify key positions and methodology for filling them.

Develop candidate evaluation criteria for required competencies.

Recommend new, or changes to, qualification standards.

Determine need for employee mobility.

Deployment

Provide recommendations on civilian work force mobilization planning and management.

Evaluate the effects of mobilization on the proponent system.

Sustainment

Identify competencies for each occupational series level.

Assess quality of work force, personnel programs and systems.

Recommend policy and procedural changes.

Separation

Recommend minimum performance standards.

Recommend changes to retirement, reduction-in-force and service obligation policies.

Several local initiatives are underway to enhance engineer civilian work force efforts. An engineer data base is being developed from the Army Civilian Personnel System (ACPERS). Information in the data base will be used to diagnose problems and project trends within the engineer work force. This data base will enable us to analyze recruitment, retention, policy and program changes, training, integration and total work force structure.

Civilian employees constitute 38 percent of the DA Active Force (as of 30 June 1991). The goal of civilian proponency is to enhance this integral part of the Army team. Today's proponency efforts will be imperative to the success of the down-sized Army of tomorrow. Drastic and far-reaching changes are expected in the Army personnel structure and proponent offices will continue to have direct impact on them. As the ombudsman for the Engineer Corps, we will do everything possible to ensure that the civilian work force is trained and ready to support the engineer mission.

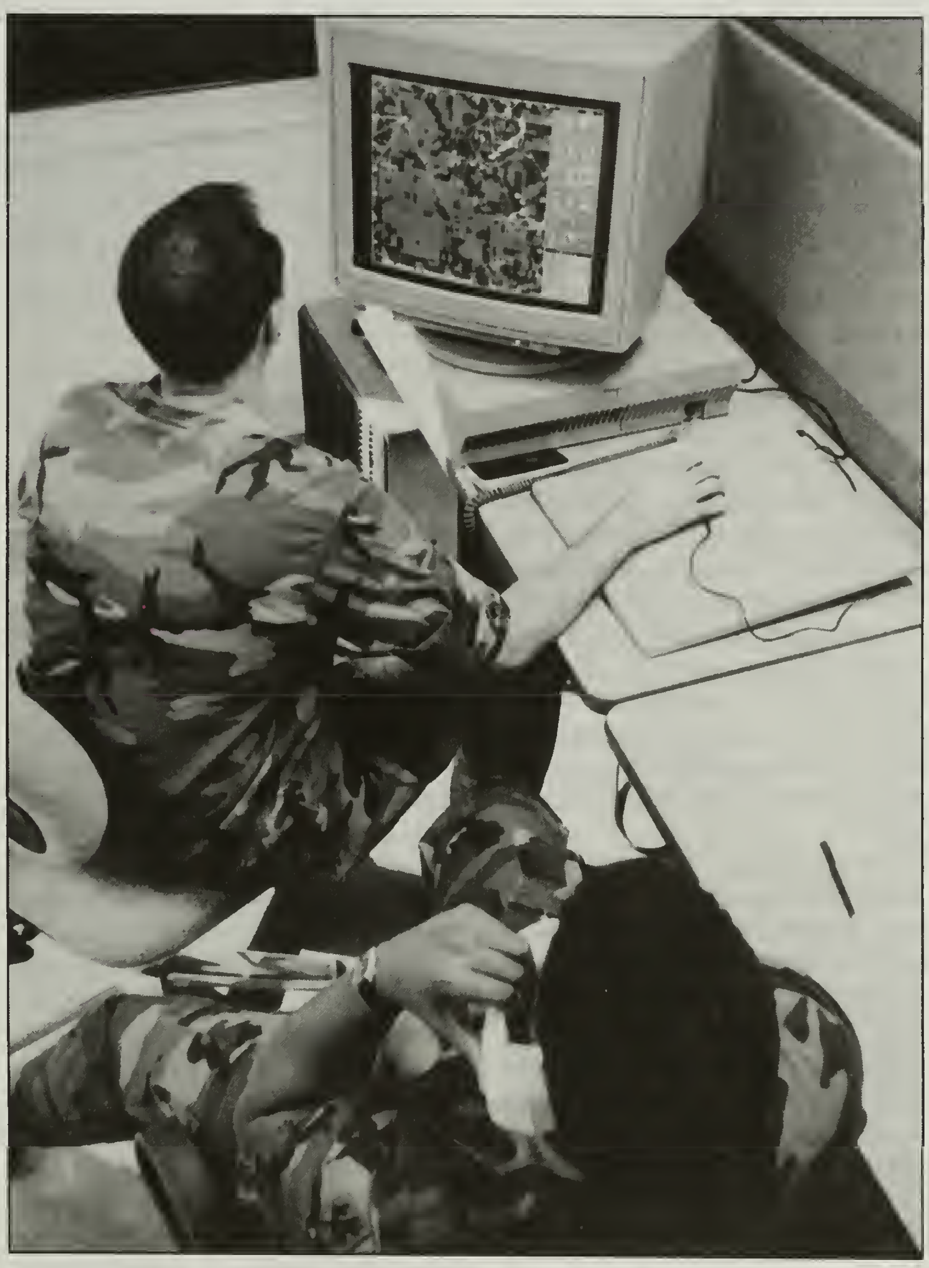
Ms. Mathews is chief of the Civilian Proponency Branch, Engineer Personnel Proponency Office at the Engineer School. She previously served as an analyst for the Directorate of Combat Developments and the Directorate of Resource Management. Ms. Mathews is past president of the Ozark Chapter, American Society of Military Comptrollers. She holds a bachelor's degree in business administration, a master's degree in management, and is a graduate of Command and General Staff College.

Computerized Combined Arms Training

By Captain Toby A. Hale

Sophisticated equipment alone does not guarantee victory on today's high-tech, high-tempo battlefield. Success also requires well-trained leaders who understand the complexities of synchronized, combined arms operations. Using sophisticated computer simulation techniques, the Engineer Officer Advanced Course (EOAC) provides students training in combined arms operations at battalion and brigade levels. The vehicle for this training is a three-day command post exercise (CPX) focusing on the planning, preparation and execution of a brigade defensive operation. This article outlines the steps of the CPX from start to finish.

Prior to the CPX, students receive classroom and field instruction on threat organizations and doctrine, defensive and offensive maneuver doctrine, fire support operations, the engineer estimate process, and engineer support to defensive and offensive operations. From this, students get a feel for the nature of combined arms operations, along with experience as members of brigade and battalion staffs. This instruction includes two tactical exercises without troops (TEWTs) covering the same terrain used during the CPX.



Students in the Engineer Officer Advanced Course (EOAC) direct a tactical operations scenario using Janus computer simulation (Photo by Phil Howell).

CPX Phases

Phase 1 - Day 1. Planning
Phase 2 - Day 2. Battlefield Preparation
Phase 3 - Day 3. Execution (am)
Phase 4 - Day 3. After-Action Review (pm)

During the TEWTs, students are out on the actual terrain conducting reconnaissance. These classes are early in the course and represent approximately one-third of the total EOAC. The culminating point for all tactical instruction is the CPX.

At the beginning of the CPX, instructors assign each student to one of the primary staff positions of a brigade headquarters, or to one of its three attached maneuver battalions. These positions include XO, S-1/4, S-2, S-3, FSO, and engineer. When available, actual battalion commanders from units on Fort Leonard Wood serve as the brigade and battalion commanders. Otherwise, maneuver branch instructors fill these roles. The CPX is divided into four phases (shown above). During Phases 1 and 3, students work in a simulated tactical environment that includes realistic mockups of each Tactical Operations Center (TOC).

During Phase 1, the brigade commander provides the "staff" with his intent and general concept of operations. From this initial guidance, the student staff issues a warning order to the battalions and develops a scheme of maneuver for a brigade defense in sector, including a battalion-sized counterattack. Once complete, the brigade staff backbriefs the brigade commander, who either approves the plan or modifies it to meet his intent. Following necessary changes, the brigade staff presents the completed plan to the battalion staffs in a brigade operations order (OPORD) briefing.

After the brigade OPORD brief, each battalion staff repeats the process followed earlier by the brigade: receiving the commander's initial concept and intent, developing a tentative scheme of operations, backbriefing the commander, and modifying the plan as required. The battalions are now ready to proceed to Phase 2, Battlefield Preparation.

To provide a degree of realism, the CPX uses the Janus combat simulation as the arbitrator. Janus is named after the two-faced Roman god of doors who was able to look both ways at once. Janus is a two-sided, free-play simulation with a "man-in-the-loop" opposing force. It is a high resolution simulation capable of replicating the full spectrum of combat, combat support, and combat service support systems and functions.

In this way, it reinforces the importance of synchronization in combined arms operations. Janus also includes an analysis function that allows instructors to record and replay the battle. This is extremely useful in the after-action review process in Phase 4.

With their plans complete, the battalions are ready to begin battlefield preparation. In the CPX, this translates to inputing their maneuver, engineer, fire support, air defense, and combat service support plans into Janus. Under maneuver, students designate each weapon system, from individual infantrymen to tanks and other heavy weapons, an initial location and sector of fire, and provide routes to subsequent and alternate positions.

In the engineer plan, students decide where to position all obstacles, insure they cover each obstacle with direct and/or indirect fires, and select which weapon systems to dig in. For the fire support plan, students can preplan artillery and mortar fires, and plan for the use of close air support and attack helicopters.

Air defense input includes positioning air defense weapon systems, designating sectors of fire, and determining if any air defense weapons require survivability positions. Finally, students input the location of ammunition pre-stock points, battalion combat trains, and again determine the survivability level required for combat service support assets. Because Janus is a high resolution simulation, students must plan the use of each separate entity, be it machine gun team, tank, road crater or fuel tanker.

During the battlefield preparation/data input phase, maneuver and engineer instructors are available for guidance and to assist in modifying the plans if required. Some common modifications required are the shifting of battle positions, adjustments to engagement areas, and relocation of obstacles to make maximum use of terrain. This is an excellent replication of the types of changes a real plan might undergo in the field. Battlefield preparation is complete once students finish inputing their various plans.

Execution of the plan takes place the following day. At the beginning of Phase 3, students can make last-minute changes to their plan prior to execution. At LD (line of departure) time, students move

Working in a mockup of a tactical operations center (TOC), EOAC students control the actions of a simulated combat arms brigade (Photo by Phil Howell).

to their TOC and conduct final communications checks with their Janus workstations. Each workstation represents one maneuver battalion. A separate workstation controls the brigade's fire support assets, artillery, close air support and attack helicopters.

As the battle unfolds, each workstation reports the actions occurring on its screen to their TOC and executes instructions from the staff. Based on input from their workstation, students make decisions during the battle. Some of the types of decisions include: when and where to shift priority of fires, when to launch counter-attacks, when to withdraw to secondary positions, and when to conduct resupply of fuel and ammunition. During the battle, the opposing force players also make decisions to stay with their initial plan, or modify it based on the changing situation. The execution phase normally lasts between four and five hours.

The final phase of the CPX is the after-action review (AAR). At the beginning of the AAR, instructors ask each battalion commander to restate their mission and give their opinion as to the measure of success in their mission. Examples include defending in sector, destroying a motorized rifle regiment, or conducting a counter-attack and destroying a enemy battalion.

Next, the students watch a replay of the battle showing both the red and blue actions as they occurred. After that, instructors lead a discussion covering each of the seven battlefield operating systems: intelligence, maneuver, engineer support, fire support, air defense, combat service support, and command and control. During this discussion, instructors ask students to provide their impressions of the positive aspects of their plan, things they would want to sustain, negative aspects, and things they would like to improve. The AARs usually last from an hour to an hour and a half, and mark the end of the CPX.

After the CPX, students have a better understanding of how the various components of the combined arms team must work together to achieve a common goal. They also develop an increased awareness of the speed, complexity and lethality of modern combat operations.

In today's environment of increasing training costs and limitations, events such this CPX provide broad-based, realistic training at a fraction of the cost and with none of the limitations of a field training exercises.

Captain Hale, an armor officer, is a combat simulations analyst with the Engineer School's Modeling Branch. He previously served as a combined arms instructor/writer for the school. Other assignments include company commander, assistant battalion S-2/S-3, company executive officer, and platoon leader. He is a graduate of the Combined Arms and Services Staff School, and Command and General Staff College. He holds a bachelor's degree in forestry management from University of Wisconsin.

The Platoon Streamer Program

By Captain Tony Vesay

Leaders who have been around for a while know that the Army "train" moves fast and never stops. And to make it even more fun, just when you are getting comfortable with the train you're on—they change the conductor.

The end result of these multiple stops-and-starts is a daily operations routine that is often conducted in an unsystematic, inefficient, and even painful manner. Further, the closer you get to where the rubber meets the road, the more chaotic it gets. Unfortunately, this is exactly where most of our junior leaders reside—along with our future.

I found a need for some sort of regimen that allows a platoon to systematically meet the boss's expectations, while allowing consistent progress toward combat readiness and team unity.

My answer is the Platoon Streamer Program. It incorporates the commander's intent, unit SOP guidance, and even allows for those ever-present "alligators." It also sustains the unit's battle focus. This program is an effective, low-cost method of communicating guidance, setting standards, and recognizing soldiers for doing a good job. In short, it gets the platoons fired up, fine-tuned, and "on board."

Making It Work

The program sets its sights on 14 sustainment areas:

Caring. Does the platoon leadership have a handle on the health and welfare of each soldier?

Safety. Is a proper safety program in place, stressing awareness and training?

Reenlistment. Does the platoon have a program to retain high-quality soldiers, as well as eliminate poor performers?

Supply. Has the platoon documented accountability and responsibility (all the way from barracks rooms to the motor pool)?

PT. Does the platoon have a total fitness program that complements its combat engineering missions?

Education. Are effective professional development and job proficiency training programs in place?

M16/M203. Are training systems in place to ensure qualified, current, and trained operators can accomplish their "shoot" mission?

M60. Same criteria as for M16/M203.

Platoon Rollout. Has the platoon met or exceeded the battalion's standards for no-notice combat readiness evaluations?

NBC. Has the platoon demonstrated its ability to operate on a "dirty" battlefield?

Communications. Are adequately trained soldiers with proper security clearances proficient in communications operations?

Training. Is there a "train for war" mentality in the platoon? Does the platoon conduct a proper risk analysis, while maintaining a METL focus on all missions?

Maintenance. Is the platoon ensuring that all MTOE equipment is fully mission capable? Are qualified and responsible soldiers operating the equipment?

Squad Readiness. During a one-day, top-to-bottom combat readiness inspection, has each squad in the platoon demonstrated its war preparedness?

The criteria listed for these areas are designed to meet four major objectives: standards, combat readiness, team cohesion, and recognition.

Standards

Standards must be clearly stated and understood. The criteria are established by the company leadership. Each month, during the company training brief, platoon leaders brief the company commander on their streamer status. The commander, XO and first sergeant then decide which platoons will receive a streamer or which will have one taken away.

Examples of typical measurements for each area include:

Caring:

- The platoon conducted a health and welfare inspection during the past month.
- No EERs or PCS awards were late during the last three months.
- At least 90 percent of the platoon participated in a community service event during the past quarter.

Safety:

- The platoon has at least one combat lifesaver per squad.
- 100 percent of the platoon's POVs were inspected during the last quarter.

Reenlistment:

- The platoon leader maintains a current list of the top five soldiers physically qualified for reenlistment (P1s).
- The platoon's assigned reenlistment goal, in all categories, was met during the last quarter.

PT:

- The platoon maintains a 250 average score, with no failures, and 5 percent have PT patches.

Training:

- The platoon maintains a 90 percent green rating on priority A METL tasks, with no less than a 75 percent rating on priority B tasks.

Maintenance:

- The platoon has at least one master driver.
- The platoon leader, platoon sergeant and squad leaders are licensed on all types of equipment assigned to them.
- All vehicles/equipment have assigned, licensed operators and assistant operators.

Each of the 14 areas has four to six measurable criteria that must be met before a platoon proficiency streamer is awarded. If a platoon has already been awarded a streamer but subsequently falls below the established standards, it is given one month to meet the criteria. If it fails to do so, the streamer is taken away. Standards are reviewed periodically to ensure they represent realistic goals.

Combat Readiness

The intent of the program here is to instill an attitude of sustained readiness, along with continuous improvement. This minimizes the old "spit-and-polish" attitude. It also eliminates the "Chinese fire drill" method of preparing for inspections—with the usual last-minute rush to get things in order. While such 11th-hour efforts are usually successful in getting a unit through an inspection, they are of little long-term value. The streamer program stresses continuous preparedness, allowing units to avoid peaks and valleys in their readiness.

Team Cohesion

A soldier without a defined mission detracts from the unit's chances for successful operations. Under the streamer program, each soldier knows his role and how he fits into the larger scheme of things. Soldiers know that they depend on each other, and they work to strengthen the bond between them. Everyone in the platoon knows that there is no "I" in the word T-E-A-M, and that each individual's goals must coincide with unit goals. The end result is a sense of worth among individual soldiers and a strong "relay team" effort toward mission accomplishment.

Under the streamer program, the "top-down," authoritative leadership style was replaced with the interactive, participative, and delegative styles. Leaders were forced to power down, and accomplish the mission at the lowest possible level. Soldiers displayed a greater sense of responsibility as a result of being trusted to do the job right—and then being held accountable for the results.

Recognition

Make it meaningful and highly visible. Streamers are awarded to platoons in company formation by the commander. Each program evaluator is then called to the front of the formation, where he outlines the accomplishments of the winning platoon. And while teamwork is emphasized, exceptional individual efforts are also recognized. The awards ceremony is held within 24 hours of the inspection, with families and battalion staff in attendance.

Even if platoons do not meet streamer standards during each inspection, they still win. The team pride, sense of individual worth, and the esprit de corps gained through the program is well worth the effort.

The streamers are displayed in the company orderly room on a 4 foot-by-4 foot platoon streamer board, which is topped by miniature platoon guidons.

Inspectors

Inspectors come primarily from company headquarters, and evaluations mirror their usual day-to-day responsibilities. For example:

Area	Evaluator
Caring	First Sergeant
Safety	Safety Officer
PT	Operations NCO
Supply	Supply Sergeant
NBC	NBC NCO

The company executive officer plays an important role in the streamer program by overseeing records and serving as a problem-solving ombudsman.

Benefits

Aside from unit recognition, the streamer inspections serve several purposes. For evaluators, the inspections allow them to keep a handle on the status of their areas of responsibility.

Likewise, it gives each platoon leader regular feedback on the readiness of his unit. For new soldiers, including leaders, it gives a clear-cut definition of standards within the company.

The streamer program also:

- Allows all soldiers the opportunity to be winners, since they're competing against a standard—and not each other (at least officially). The program allows the same streamer (safety, for instance) to be awarded to more than one platoon at a time.
- Transcends personnel turnover by ensuring consistent, measurable standards.
- Forces leaders to systematically attack problem areas with long-lasting solutions that materially improve readiness—rather than short-term fixes that simply make the unit look good.

With the help of the Platoon Streamer Program, the platoons—and the company as a whole—achieved some impressive results:

- A sustained 300 percent reenlistment rate.
- The 1989 Department of Defense Maintenance Excellence Award.
- New combat engineering records at the National Training Center.
- A 90 percent operational readiness rate on all equipment.
- A top-rated family and community support group.

The streamer program also serves as a valuable counseling tool, and is an innovative way to reward those who meet the standard. Unit performance improves, and team cohesion is strengthened because all soldiers know what is important. Evaluators become experts in their inspection areas, and junior leaders quickly understand what is expected of them and their units. Together, they form a true team working toward a common cause.

Costs

As with any new program, there are some costs. These include:

Selling the program. Change usually meets with resistance and creates confusion. Overcome this by explaining that this is not really an "add-on" program, but a systematic and innovative way of achieving unit missions.

Start up costs. It's critical to accurately answer the "what's important" and "what's the standard" questions. Be fair and realistic. The presence of a professional streamer board not only adds to the orderly room's professional appearance, but also attests to the platoons' readiness.

Maintenance costs. Keeping the program current—and the books updated—is critical. Experience has shown that leaders want to include too many criteria and set standards too high. Particularly at the start of the program, limit criteria to critical items, keep things short term, and be relatively generous about presenting streamers.

The Bottom Line

The Platoon Streamer Program is a garrison sustainment system that builds units to field excellence and toughness. It's a proven system that provides healthy competition with clear and measurable standards. Under this program, leaders learn to establish systems, set standards, inspect them, and take corrective action. Everyone knows their specific responsibilities as part of the team effort. They are held accountable for their actions, learn quickly that they can't do it all alone, and develop a great sense of spirit and confidence. In short, the streamer program makes sure that even if the train is moving fast—everyone is aboard and moving in the right direction.

Captain Vesay is a graduate student at Pennsylvania State University. He previously served as commander of A Company, 14th Combat Engineer Battalion. Other assignments include platoon leader, executive officer, battalion maintenance officer, and aide-de-camp.

Letters to the Editor

Engineer Observations

I am writing in reference to the article, "Initial Observations by Engineers in the Gulf War" by Mr. Vern Lowrey, which appeared in the October 1991 edition of *ENGINEER*. I am concerned in particular about observation #10, Topographic Support. While I heartily agree with most of the recommendations, the observation and discussion are seriously flawed.

The observation that topographic survey support and map production failed to meet the requirements of units at corps level and below is not only false, but it maligns the exceptional performance by topographic engineers during Operations Desert Shield/Storm. In fact, topographic surveyors met all survey requirements in spite of inadequate TOE equipment because they deployed non-development items such as the GPS receivers. The production of special map products was both extensive and timely, thanks in part to deployed non-development items. Map production, which is not a topographic engineer mission, was handled very well by the Defense Mapping Agency despite rapidly changing requirements over an enormous area of interest.

The requirement for rapid, down-sized, and tailored map production capabilities to support commanders at division level and below is unclear and therefore the claim "that non-developmental systems capable of meeting those needs are not tactically feasible" is also unclear. The non-developmental B&W copiers, desktop computers and even digital imagery processing systems (Corps and EAC) performed superbly under tactical conditions.

The recommendation that topographic survey capabilities should be retained in the force structure to allow engineers to map and update potential contingency theaters is technically incorrect. Surveyors do not map, they survey.

I agree whole heartedly that topographic modernization is required. But please, lets get that point across without making it sound like we failed in the Gulf. The topographic support provided by the dedicated soldiers of the 30th Engineer Battalion (T), A/649th Engineer Battalion (T), and the division terrain teams backed-up by the Defense Mapping Agency, the Topographic Engineering Center, and many others is a major success story. Topo overcame antiquated TOE equipment by rapidly adapting non-development items to provide timely and tailored support for commanders.

Let's acknowledge the success of topographic support to the Gulf War and build on the lessons learned using new technologies to integrate the required technology, equipment and training into the engineer topographic force structure.

Mark A. Fornwalt
Lieutenant Colonel
132 Engineer Detachment
Fort McPherson, GA

Mr. Lowrey replies:

The U.S. Army Engineer School agrees with LTC Fornwalt in that the topographic engineer did not actually fail in its support to Operations Desert Shield/Storm. All topographic engineers and, in particular, the topographic surveyors, demonstrated extreme resourcefulness and flexibility in meeting mission requirements. Observations from the field indicate, however, that topographic engineers were not fully prepared to provide needed topographic support to the combined arms team at the start of Operation Desert Shield, in August 1990.

Existing standard topographic products and digital data bases for the Kuwaiti Theater of Operations (KTO) were very limited. Additionally, the topographic surveyors were not adequately equipped to provide the timely and accurate positional information initially required for this theater. Both of these problems were overcome by the efforts of topographic engineers from survey and production squads to corps, echelons above corps, and CONUS based topographic engineers all working together to provide needed equipment and supplies to the theater.

Operations Desert Shield and Desert Storm provided much needed visibility to the topographic requirements of today and the future. Topographic engineers did not fail in the Gulf War. In fact, they demonstrated the ingenuity, adaptability, and bravery that has been a hallmark of the Corps of Engineers. Thank you for taking the time to write.

POC: Vernon Lowrey, ATSE-ESA, AV 676-5304, or MAJ Gary Thompson, ATSE-TDT-ES, AV 676-5440.

Letters to the editor are welcome. They should be addressed to Editor, ENGINEER Professional Bulletin, ATTN: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650.

The Mission and Enlisted Career Progression

By MSG Kathy Kindle, SFC Richard Arsenault and SFC Larry Robinson

The Engineer Personnel Proponency Office (EPPO) oversees about 27,000 engineer soldier authorizations located within the combat, general, and topographic engineering career management fields (CMFs). Each CMF is designed as a manageable grouping of related military occupational specialties (MOSs) that provides for accomplishment of the Army's mission and lays down a structure for career progression from entry level soldier to sergeant major.

Each CMF is coordinated by a specific senior noncommissioned officer within EPPO who possesses one of the MOSs within the career management field he oversees. These career management field coordinators evaluate a myriad of personnel issues and policies that pertain to one or more engineer MOSs. Their goal is to ensure that proposed personnel actions and initiatives cause as little adverse impact as possible on engineer soldiers, and yet support the Army's mission. They diligently monitor these actions so that the end result provides every soldier an opportunity for professional development, career enhancement, and career progression.

Congressional legislation has mandated a manpower reduction in the Army. This reduction will ultimately create a smaller and leaner engineer force. Combat support and combat service support units will draw down in proportion to the combat force. The most significant reductions will occur in Europe, leaving the majority of Army units based in the continental United States.

The downsizing effort represents a significant challenge to the engineer force. The present and proposed out-year authorization levels for each engineer CMF are:

CMF	***FY 91***	***FY 92***	***FY 93***
12	15,845	13,840	12,549
51	10,107	8,092	7,774
81	1,213	1,179	925
MOS			
62B	3,201	2,753	2,548

With the leaner engineer force, the Engineer School is seeking ways to maintain its present warfighting, construction, and topographic capabilities. Two major areas of interest are the Engineer Restructure Initiative (ERI) and the consolidation of certain MOSs within the 12 and 51 CMFs.

The Engineer Restructure Initiative is underway to realign and/or restructure engineer units. Construction support equipment (CSE) companies will be increased, whereas combat engineer battalions (CH) will be reduced. The chart below depicts the number of Active, National Guard, and Army Reserve CSE and CH units.

As of May 90

Unit	*Active*	*National Guard*	*Army Reserve*	*Total*
CSE	6	16	4	26
CH	14	14	17	45

Projected for FY 95

CSE	7	18	12	37
CH	8	14	13	35

Combat engineer battalions will also undergo a major restructuring in accordance with the ERI. Divisional combat engineer forces will now consist of a headquarters and headquarters detachment (HHD) and three redesigned combat engineer battalions. This will place a combat engineer battalion in each maneuver brigade of the heavy division. The ERI will significantly improve the capabilities of engineer units.

With little relief in mission responsibilities, engineer soldiers will find themselves performing a greater variety of engineer tasks. The Engineer School is actively studying the feasibility of consolidating certain MOSs within their CMFs. These consolidation initiatives are intended to make sure engineer soldiers receive and maintain the training necessary to accomplish the mission, and also have an opportunity for career progression.

One proposal under study recommends consolidating the 12B and 12C MOSs into a single MOS currently referred to as MOS 12A. If approved, all 12B and 12C soldiers would receive MOS 12A as their primary MOS. This consolidation would increase the diversity of assignments available to combat engineers because 12A soldiers could then be assigned to combat engineer or bridge units. The proposal also recommends the restructuring of MOS 12F. If implemented, MOS 12F would merge into MOS 12A at skill level four (sergeant first class). Consolidating MOS 12B, 12C, and 12F would allow greater diversity of assignments and equalize the opportunity for career progression throughout CMF 12. A chart depicting the proposed consolidation (which, if approved, will be effective in the 3rd quarter of FY94) follows:

Current

SGM
MSG

12B	12C	12F
SFC	SFC	SFC
SSG	SSG	SSG
SGT	SGT	SGT

Proposed

SGM
MSG

12A	12F
SSG	SSG
SGT	SGT

CMF 12 is not alone when it comes to restructuring. In the General Engineering CMF 51, proposals to consolidate selected MOSs are being studied that would affect soldiers in the vertical, horizontal, and technical engineering skills.

Because of low densities in the technical engineering specialties (MOS 51G, 81B, 82B, and 51T), they are being considered for consolidation into a single MOS structure. The restructured MOS will combine the skills of the surveyor, draftsman, and materials tester into an initial entry occupational identifier of Technical Engineering Specialist (MOS 51T10).

A consolidation proposal for soldiers with vertical skills (MOS 51B, 51K, 51R, and 51H) is also under study. It proposes merging the duties of the plumber and electrician together as a Utilities Specialist (MOS 51A) at the entry level. MOS 51B would remain the same at the entry level, but each specialty (51A and 51B) would progress to skill level four (SFC).

Proposals that would affect soldiers with horizontal skills (MOS 62E, 62F, 62G, 62H, 62J and 62N) are also under study. These proposals address the possibility of reallocating equipment and tasks to provide for better utilization of soldiers and their skills.

Engineer forces are undergoing rapid changes in force restructuring. Divisional engineer battalions are now in the process of forming into engineer brigades under the ERI. This article outlined several of the initiatives and proposals that are under study at the Engineer School, and some may be approved and implemented in the future. The future, at this point, is difficult to picture clearly.

One thing is certain, however: engineer soldiers will go through significant changes. And they will succeed in the unique mission of modeling and building the engineer force of the future.

MSG Kindle is the CMF 81 coordinator for EPPO. She previously served as assistant security manager for the 45th Support Group. She also served as first sergeant of the 70th Engineer Company (TOPO). She is a graduate of the Sergeant Major Academy's First Sergeant Course.

SFC Arsenault is the CMF 51 coordinator for EPPO. He previously served as a drill sergeant at Fort Leonard Wood. He has also served as a platoon sergeant for the 293rd Engineer Battalion (CBT) (HVY), and squad leader for the 27th Engineer Battalion (CBT) (ABN). He is a graduate of the Advanced Noncommissioned Officers Course, and hold a bachelor's degree in engineering management from Campbell University.

SFC Robinson is EPPO's 62B coordinator. He previously served as the NCOIC Liaison for the Operations Branch of the 800th Material Management Center. He also served as a platoon sergeant with the 502nd Support Battalion. He is a graduate of the Advanced Noncommissioned Officers Course.

Book Review

The Iranian Rescue Mission, Why It Failed, by Paul B. Ryan, 1985, U.S. Naval Institute, Annapolis, Maryland, 115 pages.

Paul Ryan retired as a Navy captain after almost 30 years of service, and has worked as a research fellow at the Hoover Institution on War, Revolution, and Peace at Stanford University since 1972. As a naval historian, he collaborated on writing two books and has written numerous articles for the New York Times and other publications.

Mr. Ryan wrote this book to explain, in layman's terms, what happened during the aborted attempt to rescue 53 American hostages in Tehran, in April 1980. His aim was to educate, not to find fault with any individual or group. Prior to this book, the only two documented accounts of the mission were classified and unclassified versions of a report by the Admiral James L. Holloway Review Group.

Mr. Ryan took an objective, unbiased view of the causes of problems affecting the rescue mission. His extensive Naval experience, combined with knowledge gained as a historian and academician, enabled him to produce a clear and insightful account of positive and negative aspects of the operation.

He lists three major causes for the failed rescue mission. The first was over-compartmentalized security. The President and members of the Joint Chiefs of Staff were so concerned about secrecy that only a handful of people knew the total plan. Individual elements involved in operational aspects of the mission were given only small parts of the plan. Thus, coordination was extremely difficult and, as a result, many things which should have happened did not. For example, flight crews did not receive weather forecasts because the weathermen did not know aviators were involved.

The second factor was the lack of coordinated planning and rehearsals needed to conduct a joint venture of this magnitude. At least three major components of the operational rescue plan practiced individually but never together or performed a final dress rehearsal. These elements were the Marine Corps helicopter pilots, who flew the mission from the carrier Nimitz to Desert One in Iran; the Delta Force, who were to conduct the raid to free the hostages from the embassy; and the Air Force C-130 pilots, who were to perform the refuel and extradition mission.

The lack of coordinated joint planning, practice, and rehearsal led to the third major factor: fragmented command and control. Marine Corps helicopter pilots were commanded and led by Lieutenant Colonel Edward Seiffert, while Delta Force Special Operations personnel were commanded by a full colonel, COL Charlie Beckwith. Overall command and control was given to Air Force Colonel James Kyle, commander of the C-130 transports. In addition to them, Major General Vaught tried to maintain control of the operation from a point in Egypt, while receiving guidance from the President and Secretary of State, in Washington, D.C.

Fragmented command and control was compounded by the compartmentalized secrecy. In short, nobody had a good handle on the big picture or could make instantaneous decisions.

I agree with Mr. Ryan's overall thesis and like his method of presenting factual information in a noncritical manner. The author states very clearly that, if existing professional organizations had been called upon to do what they are designed for, the mission might have ended differently.

I recommend this book to all officers. It presents a classic example of how not to run a special operations mission in a low intensity environment. It gives great perspective on how the decision-making process can be slowed down by layering the command and control structure at the point of execution.

Author's name withheld by request.

Changing the Warrant Officer Force

By Chief Warrant Officer Bobbie J. Campbell

The Army has always looked to the warrant officer for technical expertise. But his responsibilities don't stop there. Today's warrant officer is not only a technician, but a soldier and officer as well—one who plays a critical role in today's force structure.

This is reflected in the description of a warrant officer found in AR 611-112. *"An officer appointed by warrant by the Secretary of the Army, based on a sound level of technical and tactical competence. The warrant officer is the highly specialized expert and trainer who, by gaining progressive levels of expertise and leadership, operates, maintains, administers, and manages the Army's equipment, support activities, or technical systems for an entire career."*

Warrant officers will continue to assume more and more responsibilities—as we all must—while the military force structure goes through some dramatic changes. Recently, the very nature of the warrant officer mission was examined by a functional study group, which provided much of the foundation for the Total Warrant Officer System (TWOS).

> "Today's warrant officer is not only a technician, but a soldier and officer as well—"

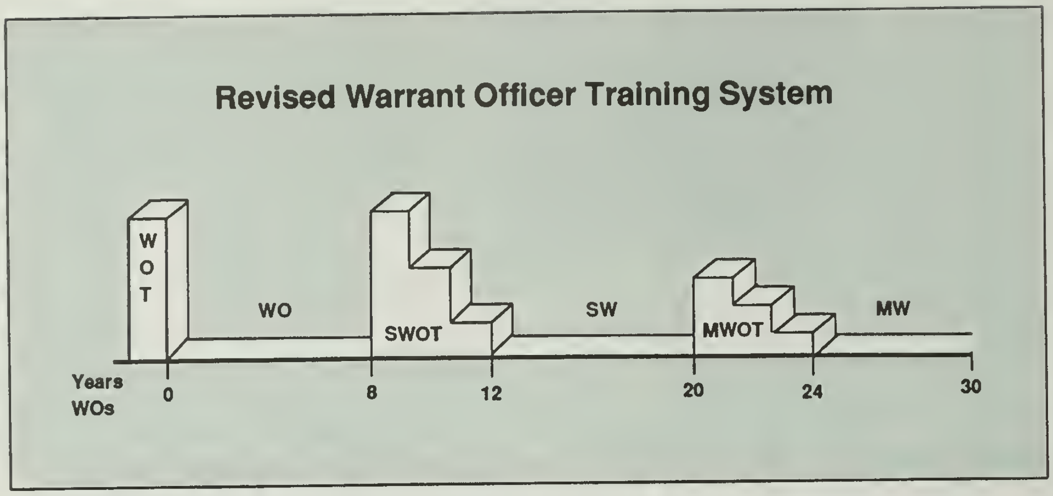
The New System

TWOS is a relatively new personnel management system for warrant officers in the Total Army (Active and Reserve Components). It was implemented as a result of recommendations in the Total Warrant Officer Study which was approved by the Army Chief of Staff in June 1985. TWOS is a disciplined, requirements-based, life-cycle management system designed to meet Army requirements for warrant officers, from initial recruitment and appointment through retirement and separation.

The implementation of TWOS has given the warrant officer force a badly needed boost in professional development initiatives. Major programs include Warrant Officer Classification By Rank Groups, the Warrant Officer Training Program, and Warrant Officer Career Management.

Classification By Rank. Under the Warrant Officer Classification By Rank Groups, the warrant officer's traditional role as a technical expert and trainer on complex systems remains unchanged. The warrant officer can expect to serve in challenging jobs at progressively increasing levels of responsibility—commensurate with his grade and experience. Tactical training ensures that the warrant officer is also prepared to lead subordinates under modern battlefield conditions.

Before TWOS, the "system" did not specify what degree of experience or skill was required for warrant officer positions in specific units or installations. When making an assignment, a personnel manager referred to authorization documents which simply reflected the code "WO," indicating that a warrant officer was



needed to fill a particular assignment. This allowed any warrant officer, WO1 through CW4, to be selected to fill any position matching his military occupational specialty—regardless of experience or length of service.

Under TWOS, warrant officer positions in Active Component authorization documents have been coded to reflect one of the three rank groups: warrant officer (W1/W2), senior warrant (W3/W4), or master warrant (MW). Until legislation is passed establishing the grade of W5, senior W4s will be selected by Department of the Army boards, and will be trained, certified, promoted to (MW4) and used as master warrant officers. This system has enabled assignment managers to fill each job with a warrant officer who possesses the appropriate skills, training, experience and grade required to meet the command's needs.

The regulation governing this action is AR 611-112, *Manual of Warrant Officer Military Occupational Specialties*. The regulation has tables showing rank codes that apply to all positions to which a warrant officer may be assigned. A separate and distinct rank table for each warrant specialty has been developed. The tables will be reviewed annually to maintain their accuracy.

Training. Training programs developed by the Training and Doctrine Command (TRADOC) have been designed specifically for each rank grouping. The respective branch proponents have functional training courses that support the TRADOC warrant training program. This training will precede each officer's utilization in the three successive career phases (see chart). Officers will be certified at each phase to ensure they meet appropriate technical and tactical standards.

Under initial TWOS training mandates, warrant officer candidates receive officership and technical training prior to appointment to jobs coded for W1/W2. After gaining on-the-job experience and selection for promotion to CW3, warrant officers attend senior warrant officer training to prepare them for jobs at the W3/W4 levels. Successful completion of the master warrant officer course is a prerequisite for warrant officers selected for MW/W5 assignments.

The engineer branch is ahead of most proponents in the development of warrant officer training courses for both the Active and Reserve Components. Certification and senior course instruction is now available for all specialties: 210A (utilities operation and maintenance technician), 213A (engineer equipment repair technician), and 215D (terrain analysis technician).

Career Management. The TWOS has changed personnel management policies that affect schooling, promotion, assignments and retirement. Warrant officers are now managed by years of warrant officer service rather than by years of active federal service. This means the personnel management "clock" is reset to zero when an enlisted soldier is appointed as a warrant officer. It enables each officer to retain seniority for purposes of pay and retirement, while affording him the opportunity to serve a full 30 year career as a warrant officer—or reach the mandatory retirement age of 62 (whichever comes first).

Other TWOS changes affect the warrant officer force. Warrant officers must be integrated into the Regular Army (RA) upon promotion to CW3. Officers promoted to CW4 can serve at least 24 years of warrant officer service. Those selected for training and utilization as master warrant have the opportunity to serve a full 30-year warrant officer career. Along with the integration policy, guidelines have been established to provide mandatory separation for warrant officers—much like their commissioned counterparts—after two non-selections for RA promotion.

WOMA

The next and final stage of implementing the TWOS is the Warrant Officer Management Act (WOMA), designed to improve the professional climate for warrants. The current version has been passed by the Senate and is now under consideration by the House of Representatives.

Traditionally viewed as highly trained and experienced technical experts, today's warrant officers are seen as well-rounded professionals—trained in the tactical as well as technical arts (U.S. Army photo).

WOMA has four major components: a single promotion system, management by years of warrant officer service, selective early retirement, and promotion to CW5.

Promotion System. With TWOS, warrant officers will be promoted under a single promotion system, instead of the present dual system. All promotions will be permanent. Officers who are twice non-selected will be retired or separated. This is the same system used to promote commissioned officers and it goes a long way toward leveling the playing field for warrant officers.

Management by Years of Warrant Officer Service. Despite the potential for lengthy service as a warrant, normal retirement eligibility will not be affected, and officers with 20 or more years of active federal service may retire if they desire.

Selective Early Retirement. Under WOMA, the Army may select retirement-eligible RA officers, not on a promotion list, for involuntary early retirement. In the current downsizing environment, this will allow the Army to retain high quality officers not yet eligible for retirement while selecting officers of lesser quality for early retirement.

Promotion to CW5. Under WOMA, the Army will be allowed to promote CW4s and MW4s to the rank of CW5—with no more than 5 percent of the warrant officer force holding this grade. The CW5 promotion action will provide a badly needed incentive to retain high quality, experienced officers.

213A

Another significant change impacting on engineer warrants is the switch of 213A proponency from the engineer branch to the ordnance branch. This action is the direct result of a TRADOC analysis of all logistics MOSs, which led to the alignment of several combat service support MOSs—warrant officer and enlisted—from their present branch proponents to ordnance. Transitional work groups from both the Engineer School and the Ordnance Center and School are now cooperating to evaluate the requirements of the affected MOS, define the transition areas, and develop an implementation plan.

Today's Warrant Officer Force

Warrant officers merit greater challenges, more responsibilities, and more opportunities to further contribute to the Army mission. Always a valuable resource, these new changes in warrant officer management programs will make these soldiers an even more vital part of the Total Army.

CW4 Campbell is the warrant officer specialties coordinator for the Engineer Personnel Proponency Office at Fort Leonard Wood. He previously served as training committee chief of the Engineer Equipment Maintenance Committee, 1st Engineer Brigade. Other assignments include logistics/-maintenance technician for Honduras construction projects, and battalion maintenance technician for combat heavy and division combat engineer battalions. He is a graduate of the Engineer Warrant Officer Senior Course and Master Warrant Course, and holds a Master's Degree from Webster University.

Department of Offense:

We Must Swing the Pendulum Back!

By Colonel Robert J. Greenwalt, Jr.

Editor's note: *A different perspective on this topic will be presented as the Personal Viewpoint in the April issue of ENGINEER.*

For years our Army concentrated on the defense. Three generations of soldiers trained to defend Europe against an overwhelming attack—"to fight outnumbered and win." Through the "mobile and area defense," Active Defense, and AirLand Battle doctrinal evolutions we emphasized the defense. We do so no longer. The Army now focuses on the attack.

In 1985 MG Palmer, 1st Armored Division Commander, lectured that "It will take ten years to change the American Army to think offense." He was slightly pessimistic — we have already arrived. Between Desert Storm and the new AirLand Operations, the Army is now clearly preoccupied with the offense. We have reached the philosophic condition of France in 1914, with the potential for disaster this implies. Unfortunately, every future enemy will not be led by Saddam Hussein! The tactical pendulum, swinging between offense and defense, is out of balance. It has swung too far.

Engineers led the way in developing an offensive ability. Ten years ago the Army could not attack through enemy obstacles. We developed techniques and procedures, and embodied them in battle drills and counter-obstacle teams. We developed doctrine, and published it in FM 90-13-1. We developed procedures at Fort Irwin and Hohenfels to test our ability to fight through obstacles. We developed leaders and trained units at those facilities using the new tactics, techniques, and procedures under the new doctrine—and we solved the problem.

By focusing our energies on enabling the force to move, we succeeded. But in gaining the ability to attack, we lost the ability to defend.

Obstacles Thought Ineffective

Today we have the techniques to integrate obstacles with fire and maneuver in the defense, but the Army is no longer interested. The sheer exhilaration of charging across the desert in invulnerable armored vehicles has warped the maneuver view of war. The success of FM 90-13-1 and new breaching equipment have convinced the tactical community that obstacles aren't effective. The Army doesn't realize that juvenile Iraqi tactics made Iraqi obstacles irrelevant: They contributed nothing to the defense. Where tacticians formerly didn't understand the importance of breaching, they now don't understand the value of obstacles.

U.S. Mine Warfare Capability Inadequate

We have an unworkable mine warfare system. It feeds the maneuver commanders' fear of mines and produces ridiculous rules of engagement, such as retaining control of scatterable mines at Corps or even a total prohibition against mining. We have unacceptable mine hardware—either clumsy, Korean War vintage mines or excessively expensive and marginally effective modern scatterables. We have an unworkable minefield marking and recording requirement that simply adds to maneuver commanders' fear. Today mines bring problems with no justifying advantages.

Engineer Structure Inadequate

Under the engineer restructure initiative (ERI), we are losing the ability to establish a defense. It is now difficult to prepare survivable battle positions, artillery positions, and command posts. The ACE has marginal digging ability. The SEE is gone from the division. The bulldozer and bucket loader are gone from the division. The air compressor with its tools, the hydraulic tools of the SEE, and pioneer electric tools are gone from the division. Installing

(Continued on page 36)

Terrain Analysis For Desert Storm

By Warrant Officer Terri L. Metzger

Accurate and up-to-date mobility overlays were critical to the success of Desert Shield/Storm operations. But making them for maneuver units was not easy. Limited availability of current map sheets, lack of an up-to-date terrain data base, absence of terrain collection equipment, and limited training in desert mapping techniques made the job of intelligence and topographic soldiers difficult.

A terrain team from the 513th Military Intelligence Brigade, based at Fort Monmouth, supported by personnel from the 30th Engineer Battalion (Topographic), Fort Bragg, used a variety of techniques to overcome these obstacles. Their work provided much of the mobility information needed by ground commanders in their rout of the Iraqis.

The 513th terrain team, consisting of a warrant officer and five enlisted terrain analysts, initially deployed to the Gulf on August 29, 1990. The team quickly began developing cross-country mobility overlays of the region, using LANDSAT imagery, maps and a terrain data base that were from eight to 20 years old, along with written area studies.

While this initial analysis was a "quick and dirty" assessment, it proved to be more accurate than any other information available at the time. For example, our analysis directly contradicted the existing data base, which depicted much of the desert region as severely restricted.

On September 4, the team conducted its first terrain reconnaissance mission. Included was the northeast coastline and the Kuwaiti border east to the Wadi Al Batin (near the tri-border region). The team did not have any cone pentrometers or soil collection kits, so it used four-wheel drive vehicles instead. Simply driving across the terrain several times helped to determine trafficability, and the terrain's ability to support military operations. From its observations, the team made estimates of trafficability for both heavy wheeled vehicles and tracked vehicles.

The recon efforts, documented with 35mm photography, paid off. While the surface of the desert appeared hard, off-road driving created enormous dust signatures. And the Wadi Al Batin, previously described as a steep-sided gully that could not be easily crossed, was, in fact, a very gently rolling plain—barely noticeable as a distinct geographic figure.

All together, the team conducted six ground and three aerial reconnaissance missions. Information was cross-checked with available LANDSAT images, and with evaluations made by other terrain teams accompanying coalition for-

A LANDSAT image of Kuwait, one of the many used by the terrain team to construct and verify mobility overlays for coalition combat forces (U.S. Army Photo).

LANDSAT images, and with evaluations made by other terrain teams accompanying coalition forces. Once information was fully analyzed, the team produced a cross-country mobility overlay for use by tracked vehicles during the region's dry season. The recon and evaluation process was repeated with the arrival of the wet season.

Because there were still some areas with questionable trafficability, the team sought assistance and advice from various sources. Additional imagery was obtained from camera platforms operating in the Gulf region, and intelligence sources were consulted for more terrain data. The Kuwaiti military was also a valuable source of information. The team debriefed Kuwaiti artillery and armor personnel who were familiar with the areas being studied. First-hand information was also obtained from Bedouin tribesman who traveled extensively throughout the region. This information was used to refine the overlay, which was briefed to the coalition commander on November 7.

Further refinement and production of overlay materials went beyond the terrain team's capabilities, and the group was augmented by personnel from the 30th Engineer Battalion (Topographic). Their combined efforts provided coalition forces with trafficability updates, briefings, recon missions, and overlays showing pipelines, oil wells, enemy obstacles, and roads. The group also provided briefings for field commanders which detailed mobility issues within their sector.

In addition to mobility overlays, the terrain team prepared obstacle overlays for maneuver forces. They plotted the locations of minefields, fire trenches, antitank ditches, wire emplacements, and berms. Probable breaching sites were imaged and the photos turned into useable products by the 30th Topo.

Division templates at a 1:50,000 scale were plotted on mylar, and then overprinted on maps.

Getting the maps was no easy task. Up-to-date map sheets were hard to come by, and there was no current terrain data base to work from. Until the Gulf crisis, maintenance of maps and a data base for the region had been a low priority. The Defense Mapping Agency (DMA) produced quick-response 1:100,000 color image maps based on LANDSAT images. Concurrently, the agency proceeded with work on 1:50,000 maps needed for maneuver operations.

Working in a desert environment also took some getting used to. Before Desert Shield/Storm, training emphasis at the Defense Mapping School was geared toward terrain information in areas like Germany and Korea. The region backdrop raised relatively unfamiliar issues of desert trafficability, desert terrain feature terminology, and new map

Terrain team members conduct a ground recon of an area near the Saudi-Iraqi border. Such recons helped the team to quickly compile and update information for maneuver overlays (U.S. Army photo).

symbols. The 513th terrain team had some experience interpreting multispectral imagery, but desert imagery was new to them. Constant comparison of map sheets with LANDSAT imagery was necessary to ensure accurate terrain depictions. In one case, an area was labeled as linear dunes, when in fact the dunes were scattered. Without the use of LANDSAT, maps given to maneuver forces would not have been as accurate as they needed to be.

During Desert Shield/Storm, terrain data information evolved rapidly. Accurate and timely information collection and close coordination of effort between terrain teams were important factors in the success of the terrain analysis effort in the Gulf.

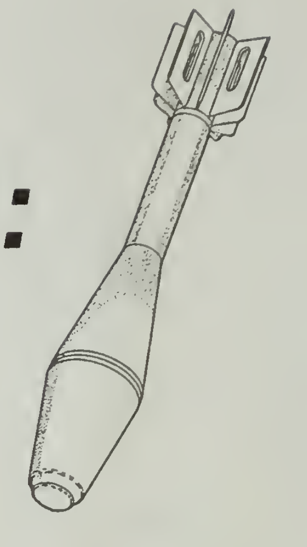
The Iraqis were formidable engineers and made significant changes in the desert landscape. In addition to extensive minefields and other obstacles, new and improved roads began to appear soon after the invasion of Kuwait. Initial reports on these new highways sometimes conflicted as to the exact location of the roads, and often did not contain important information on alignment, surface materials, width, or vehicle traffic. Requests for additional, follow-up information took too long (4 to 10 days) to process, and hindered the production of up-to-date overlays.

To improve the accuracy and timeliness of terrain products, the team requested that the various reporting sources include more detailed information with each of their reports, and, if photographs were available, include location coordinates directly on the photo. Additionally, to double-check the accuracy of reports, the team requested "change pairs" of LANDSAT images (images of the same area taken on two different dates, and compared for changes in terrain features).

In a further effort to keep abreast of field activities, terrain teams at every echelon maintained contact with each other to share information and techniques. Such coordination also helped to make sure products were standardized and work duplication was kept to a minimum. To help the teams, XVIII Airborne Corps, the 513th, and the 30th Topo sponsored regular terrain conferences to discuss problems and compare products.

While the desert backdrop provided some new challenges for terrain analysis, the 513th Terrain Team, along with the 30th Engineer Battalion (Topographic), succeeded in providing timely and accurate mobility overlays for combat forces. Terrain information gathered during the operation is now being used to refine the Gulf terrain data base, and the units' experience is being tapped to improve desert analysis operations.

Warrant Officer Metzger is a terrain analysis technician assigned to the 1st Infantry Division. During Desert Shield/Storm, she served as a terrain analysis technician with the 513th Military Intelligence Brigade.



LESSONS LEARNED:

Handling Unexploded Ordnance

By Mr. Vernon Lowrey, Lieutenant Colonel Harold D. Moore, and Captain Paul Adkins

The following Lessons Learned apply to soldiers who confront unexploded ordnance (UXO) in training or on the battlefield. They are based on engineer observations made during Operation Desert Storm. For more information, write to Commandant, U.S. Army Engineer School, ATSE-ESA, Fort Leonard Wood, MO 65473-6630. Or, call (314) 563-5304, DSN 676-5304. You may also write the Director, Explosive Ordnance Disposal Center for Training and Technology, U.S. Army Ordnance Materiel and Munition School, Attn: ATSK-X, Redstone Arsenal, AL 35897-6801; or call (205) 876-1921, DSN 746-1921.

ISSUE: The large number of UXO found in Iraq and Kuwait caught U.S. and allied forces by surprise. Because lessons from past conflicts were not learned, we sustained an unacceptable number of casualties among our soldiers, allies, and civilians. Combat engineers with limited training were tasked to clear large areas of UXO.

DISCUSSION: Unexploded ordnance are military munitions (tank and artillery rounds, bombs or bomblets, submunitions, missiles, rockets, etc.) that have failed to detonate by malfunction or design. They are sometimes called "duds." When a potential for UXO exists, soldiers must perform several tasks to predict, identify, mark, report, and remove them.

Prediction. Allied forces must predict possible locations and quantities of UXO as soon as areas are known or suspected. Most of the UXO found during Operation Desert Storm were either cluster bomb unit (CBU) submunitions dropped by allied air force bombers, or field artillery dual purpose improved conventional munitions (DPICM). Both types had dud rates ranging from 2 to 10 percent. UXO "footprints" (areas of possible UXO concentration) were not tracked; therefore, information about their whereabouts was not available to mobility planners. Information about UXO concentrations was only available when reconnaissance units stumbled upon CBUs and DPICMs. The need to gather UXO information was not specified in maneuver unit reconnaissance collection efforts.

Identification. Adequate training on how to identify UXO was not conducted prior to the ground assault. Training aids such as inert devices, booklets, and posters, were not available until after the cease fire. Numerous casualties occurred when soldiers picked up UXO and moved them. Vehicles were damaged and tires were blown when vehicle operators drove into UXO areas not knowing munitions were scattered on the ground.

Marking. No standard marking systems were in place prior to the start of the ground war. After UXO areas were identified, marking normally consisted of placing tape and U-shaped pickets around the area. Some individual munitions were also marked with tape. Current minefield marking systems were inadequate or not available, forcing units to use field expedient measures.

Marking was critical because shifting sands covered and uncovered UXO areas. Not all UXO concentrations were marked by U.S. forces before they left Iraq and Kuwait, leaving dangerous areas for the civilian populace.

Reporting. Reporting procedures for UXO from units to explosive ordnance disposal (EOD) teams were confusing. Some units reported UXO using scatterable mine reporting formats. Others created their own. Some areas were cleared or marked but were not reported. Others were reported but were not cleared or marked.

Removal. The magnitude of UXO overwhelmed EOD assets. There were not enough EOD teams to clear the large areas of UXO encountered. Therefore, maneuver units tasked supporting combat engineers to mark and clear large areas of UXO under the technical guidance of EOD. Engineers cleared areas with manual techniques such as demolition "pop and drop," using a block of explosive that had been primed with nonelectric initiating systems. The fuze lighter was pulled (popped), which ignited the time fuze, and the charge then was placed (dropped) near the UXO, causing a detonation. Vehicles such as the M9 Armored Combat Earthmover (ACE) were used to push soil containing UXO out of the way. Some engineers were killed when they failed to ask for or follow EOD guidance or use common sense. The remaining UXO in the Kuwaiti Theater of Operations are being removed under contracts between U.S. firms and the host nation.

RECOMMENDATIONS: All commanders must consider the impacts of large quantities of UXO on the modern battlefield when they plan maneuver and logistics support operations. The UXO problem is not just an engineer or ordnance problem, it is an Army, Joint Chiefs, and allied problem.

Army doctrine calls for maneuver forces to attack through areas contaminated with duds left by aircraft and artillery preparatory fires. Logistics forces may need to establish bases in areas contaminated by UXO. This means that land forces will continue to find UXO when they maneuver and sustain forces on future battlefields. The following recommendations are currently being studied by the U.S. Army Explosive Ordnance Disposal Center for Training and Technology and U.S. Army Engineer School. All units must heed these recommendations to ensure troop safety in training and when confronted with UXO on the battlefield.

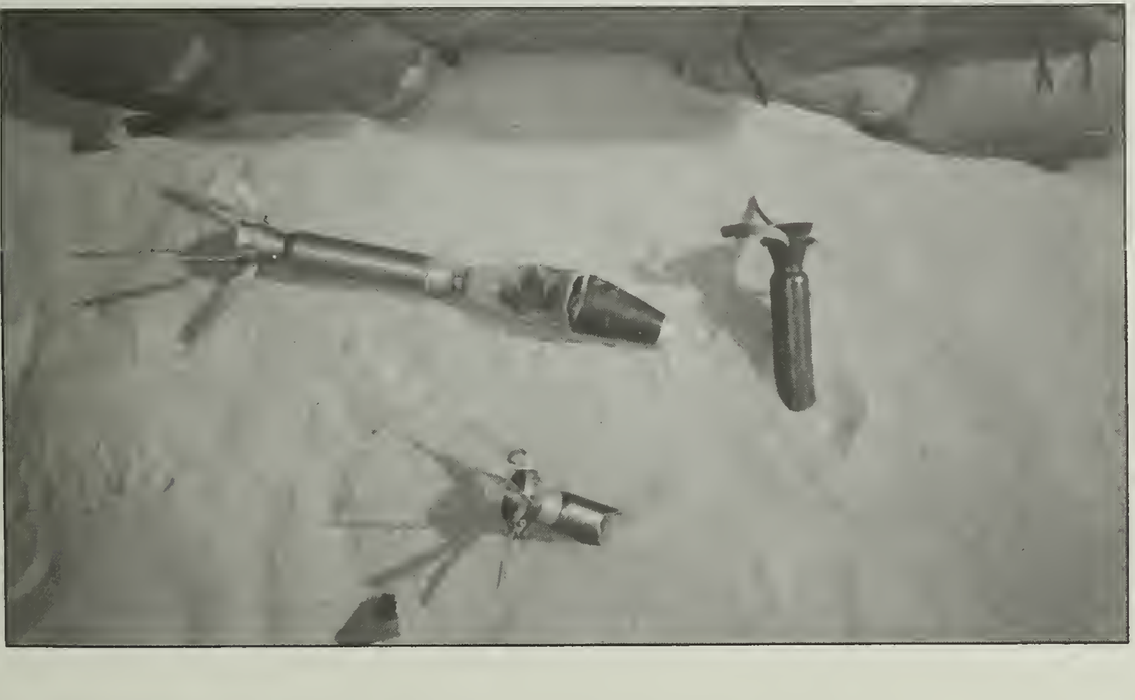
Prediction

Short Term: Air Force CBU and Field Artillery DPICM footprint information must be made available to mobility planners during the intelligence preparation of the battlefield (IPB) process. Planners must include munition dud rates when estimating UXO concentrations. They must identify UXO footprint areas, consider them obstacles to mobility, and deal with them. They must include the gathering of UXO information in reconnaissance plans.

Long Term: Combat developers must integrate footprint information into the maneuver control system (MCS). They must develop munitions with a self-destruct capability, which will preclude most problems with friendly UXO concentrations. The development of inert rounds for bombing or artillery firing will relieve the contamination of hazardous live munitions on training ranges.

Identification

Short Term: All units must develop training plans that will ensure their soldiers can identify friendly and threat ordnance. Training aids such as posters and inert devices should be available to units for ordnance identification training. Combat training centers should provide UXO identification training opportunities.



Dual-purpose improved conventional munition (DPICM) fired from friendly artillery systems. Unexploded ordnance can come in any shape or size. Don't pick them up! Mark them and report them! (U.S. Army photo)

Long Term: UXO identification must be incorporated in the common task training (CTT) portion of the skill development test (SDT), and in Initial Entry Training (IET) and officer basic courses. All skill level one soldier training should focus on safety awareness and initial reporting procedures. Training for skill level two soldiers should focus on the items for skill level one, plus how to supervise soldiers using rifles to detonate UXO from a safe distance. Skill level three training for combat arms, ammunition handling, military police, and combat engineer soldiers must include the previous items plus advanced UXO recognition and destruction techniques. Formal unexploded ordnance agents (UXOA) training should be developed and identified in AR 350-1. Also, the Army should create an additional skill identifier for soldiers with UXOA training.

All units that deploy in support of contingency operations should conduct refresher UXO identification training either at their home station or immediately upon arrival in theater. This training should emphasize theater-specific ordnance.

Marking

Short Term: Units must stock field-expedient marking materials, such as fluorescent tape, pickets, barbed wire, chemlights, etc. Theater, corps and division headquarters must develop and train standard UXO marking procedures.

Long Term: Engineer and ordnance communities must develop doctrinal UXO marking procedures and lightweight marking materials.

Reporting

Short Term: Theater, corps and division headquarters must develop standard UXO reporting procedures. They may accomplish this by modifying current scatterable minefield reporting procedures for UXO.

Long Term: Combat developers must integrate UXO reporting procedures into the maneuver control system.

Removal

Short Term:

a. **Self-Extraction.** All units must be prepared to extract themselves from UXO without assistance. Self-extraction includes reconnaissance and clearance of egress routes using manual and mechanical techniques. Units must develop techniques based on the materiel and personnel available, and incorporate these techniques into battle drills. For example, firing rifles to detonate UXO from a safe distance.

b. **Mobility Operations.** Combat engineers will continue to be tasked to support mobility operations in breaching obstacles containing UXO. They will also clear UXO from main supply routes, combat roads and trails, airfields, command and control nodes, and logistics bases.

c. **Render Safe Operations.** Engineer and maneuver units can blow in place about 99 percent of UXO using rifles and demolitions. EOD retains the primary responsibility for turning off and rendering safe the remaining 1 percent using special tools, equipment, and skills, so that the UXO do not explode and destroy friendly targets nearby. This is important when UXOs threaten materiel, personnel, operations, and facilities critical to the war effort.

d. **Clearance.** Removing all UXO in administrative areas is an EOD supervisory function, with assistance provided by host country or contracted forces.

Long Term:

a. A mechanical, self-extraction capability is needed for all units. A lightweight plow mounted on unit vehicles may be adequate.

b. The U.S. Army Ordnance Materiel and Munitions School and joint and allied agencies must review, update, and publish current UXO removal doctrine and training policy.

CONCLUSIONS: Unexploded ordnance will continue to be a problem on the battlefield. All soldiers must be able to identify, mark, and report the location of UXO. All units must be able to extract themselves from UXO concentrations. Most UXO can be blown in place by maneuver and engineer forces. Removal of critical UXO remains an EOD responsibility. Combat engineers may be tasked to breach UXO as part of mobility operations.

As improved conventional munitions (ICM) continue to proliferate worldwide, UXO incidents on the battlefield will increase. Because threat forces are using more ICMs, unexploded ordnance remains a killer on the battlefield. The Army cannot continue to ignore the lessons from Operation Desert Storm and past conflicts.

The bottom line is: *We Must Keep 'em Safe!*

Vernon Lowrey is chief, Analysis Division, Directorate of Evaluation and Standardization, at the U.S. Army Engineer School. Lieutenant Colonel Harold Moore is director, Explosive Ordnance Disposal Center for Training and Technology, at Redstone Arsenal. Captain Paul Adkins is a concepts officer in the Directorate of Combat Developments at the Engineer School.

M113 APCs:

Are They A Death Trap?

By Captain Miguel Torres

Accidents involving the M113 armored personnel carrier (APC) have plagued the Army for several years. During fiscal years (FY) 1989-91, M113 accidents drained more than $5 million from Army funds. Nineteen soldiers, including two in the Engineer Branch, lost their lives. As with most accidents, human error was the major cause or was a contributing factor to them.

This information is of special significance to our branch because the Engineer Branch is moving toward mechanization at an accelerated pace. The M113 APC is replacing our old work horse, the 5-ton dump truck, and will be used as a prime mover as well as a combat vehicle. Many engineer units are now expected to provide structured training on how to operate these vehicles. We can help you set up a training plan that will promote safe operating procedures and reduce or eliminate this type of accident.

Part of this article identifies sources for training standards. The rest describes hazards identified from historical data in the Army's safety information data base.

There are several sources for the standards and criteria used to identify, select, and train operators, commanders of tracked vehicles, instructors, and examiners. Field Manual (FM) 21-17, *Driver Selection, Training and Supervision for Tracked Combat Vehicles,* produced at the Armor Center and School, should be available to every unit using tracked vehicles. Another source is Training Circular 21-306, *Tracked Combat Vehicle Driver Training,* which is scheduled for distribution in the second quarter of FY 92.

(Continued on page 40)

An out-of-control tracked vehicle often rolls over. When it starts to roll, get inside. Your chances of surviving with only minor injuries are a lot greater when you are inside and can brace for the impact (U.S. Army photo).

The Leadership Process

By Major Richard A. Wagner, Jr.

> "In years past, instruction in the art of leadership was scarce, and consisted primarily of reading about the exploits of successful leaders."

Historically, leadership has been considered to be a somewhat obscure science. Conventional wisdom has held that leaders are either born with a natural flair for leadership, or somehow develop the ability through years of well-placed experience. In years past, instruction in the art of leadership was scarce, and consisted primarily of reading about the exploits of successful leaders.

Since the Vietnam conflict, however, the Army has made a deliberate effort to teach leadership in the same way other military subjects have been taught throughout the years. To facilitate that effort, the Army wrote two leadership manuals. FM 22-100, *Military Leadership*, is a valuable resource that all soldiers should read and understand. It offers many tools and techniques that will enhance the leadership abilities of any soldier.

However, I find that the manual does not provide a complete framework for the subject of leadership. It does not define exactly what a leader must do and how he should go about doing it. After going through the manual, a young sergeant or lieutenant is still left wondering exactly what it is that he should be doing. I believe that leadership is a process that, properly outlined, can give the inexperienced leader a start in the right direction.

I'm not saying that leadership is simple—it is not. Portions of the leadership process can be very complicated. But the overall process is simple to comprehend and provides the needed framework to bring existing leadership doctrine together into one focused concept.

The second leadership manual is FM-22-103, *Leadership and Command at Senior Levels*. I find the mere existence of this manual to be a little puzzling. It implies that leadership in the senior grades is so different from the rank and file that a totally separate manual is needed. To the contrary, I believe that leadership remains essentially unchanged as a leader progresses in rank. Senior leaders use the same process—and many of the same techniques—as junior leaders.

The Process

First, let's examine the leadership process. FM 22-100 defines military leadership as "a process by which a soldier influences others to accomplish the mission" by providing purpose, direction, and motivation. However, the process is not described.

To fill this gap, I offer a definition of the leadership process. I believe that leaders go through this process at all levels and in all situations. This process tells the leader what he must do at the most fundamental levels. Understanding the process and its situational nature is the first step towards being an effective leader. The process is modified depending on the situation, but the basic process endures. Here it is.

The leader must first decide what to do. Then, he must decide how to do it. Lastly, he must ensure that it gets done.

Simple and easy to remember. Let's take the basic idea and flesh it out just a bit more.

A leader must:

1 - Set the goal/mission.
2 - Develop a plan.
3 - Communicate the plan.
4 - Supervise execution of the plan.
5 - Continually build a motivational climate.

Figure 1 depicts the process and it's accompanying subprocesses in more detail. FM 22-100 is a fine collection of tools and techniques. Many of these subprocesses are explained in great detail in the manual. Now, let's take a look at those main steps.

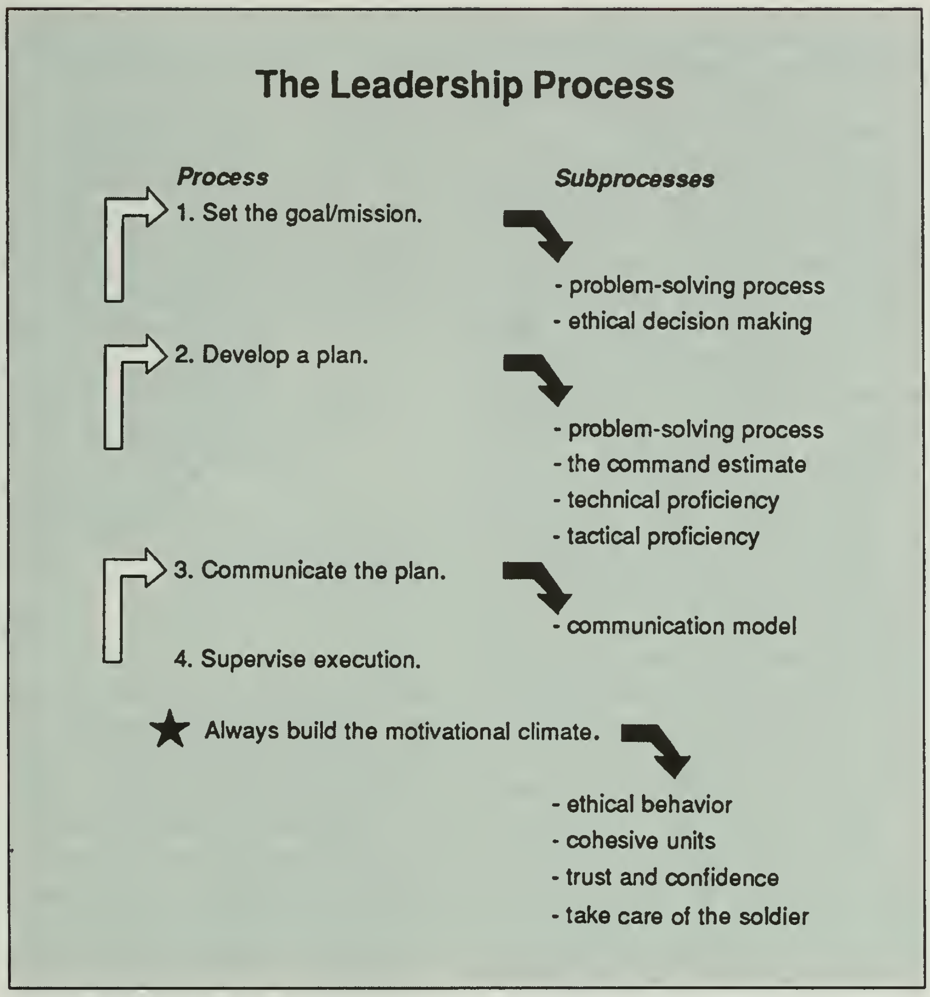


Figure 1

The first step of setting the goal gives the organization its direction. It answers the "what to do" question. It must be realistic and obtainable. The second answers the "how to do it" question. A plan to achieve the goal is developed and refined. The leader should consider several plan alternatives to ensure that all possibilities are evaluated and personal prejudices are minimized. The leader should use the problem-solving process and the ethical decision-making model, as explained in FM 22-100.

Communicating the plan and goal to those who must execute it is a particularly critical step. Failure to communicate will cause problems, delays, and even failure. Bad communication is perhaps the most common cause of mission failure. Good leaders are excellent communicators. FM 22-100 presents many helpful techniques for effective communication.

Once the order is given, the leader must supervise execution of the plan. He has the ultimate responsibility to ensure that it gets done right, and he must follow up to ensure that orders were properly understood. If mission changes are received, the plan may need to be changed. If so, then further decisions are made and communicated. The leadership process is cyclical, as illustrated in Figure 1. At any point in the process, the leader may be forced to drop back a step or two and start over.

The last step is not really a step yet it is the most important part of the process. Leaders must always work to build a motivational climate in which their subordinates will strive to accomplish the mission.

Motivation

Motivation is the key to effective leadership. Motivating soldiers to accomplish the mission is the most difficult and important part of leadership. It is the element of leadership that differentiates it from mere management. Management is a subset of leadership. Managers make decisions and formulate plans. They allocate resources and decide how they will be used. Leaders must also manage, but they are faced with an additional challenge. They must motivate their subordinates to follow the plan, use the resources, and ultimately accomplish the mission. That's the really tough part. It doesn't matter if you have the best-trained men, a fool-proof plan, or the best equipment. If your men are not motivated to perform—you're not going to get the job done.

Conversely, motivated soldiers can overcome much adversity and even bad planning. Military officers and NCOs must be particularly concerned with motivating their soldiers. We must be able to override the natural self-preservation instincts that soldiers feel in combat. That is a considerable challenge, to say the least.

Your men will follow you primarily for four reasons. First, they have trust and confidence in your abilities as their leader and in themselves as soldiers. They know that you will make the right decisions and do the right thing. And this trust does not come automatically. You must earn it. Their self confidence comes from good training. Secondly, they are part of a team. Again, this is something you must build. Next, they have intense personal pride and believe in what they are doing. You must strive to build the self-esteem of every soldier in your unit. Lastly, they fear punishment. This is the worst way to motivate soldiers. It promotes minimal performance. The more positive means of motivation foster a maximum effort from every man and gives the unit the strength that comes from a combined team effort. You should habitually practice the first three and reserve the last one as a final resort. Now, let me offer some ideas on building a good motivational climate.

Ethical behavior is essential to creating a good motivational climate. Gain your men's trust and confidence by always acting in an ethical manner. You will instantly lose it if you lie, cheat, or steal. Would you follow a dishonorable man? I wouldn't. And neither will your men. An unethical man will not be able to lead his men—and therefore cannot be tolerated. Unethical behavior undermines and ultimately destroys the motivational climate.

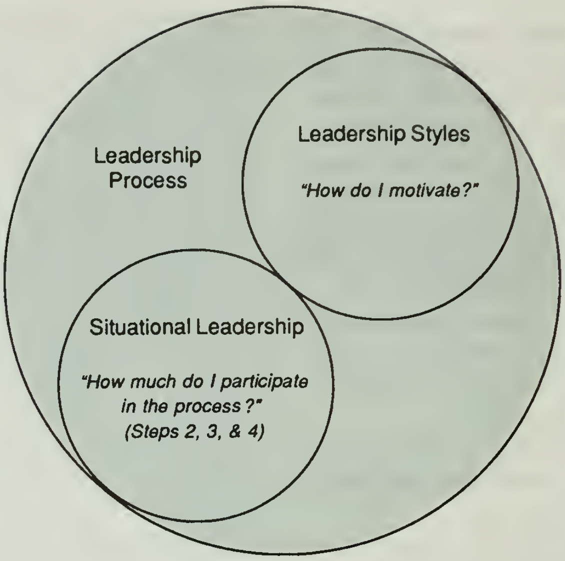


Figure 2

Build a cohesive team at all levels. The team gives the individual soldier a strength far beyond his individual limits. The team allays his fears. A cohesive unit works better, withstands the rigors of combat better, and survives longer on the battlefield. Always strive to have your units work together as a unit. Get a mascot. Develop a unit motto. Do anything to help the soldier identify with the unit. Make it his second family.

Take care of the soldier. He must feel that you genuinely care about his well being. If you do not genuinely care, you should not be an Army leader. There is a fine line between learning to train under adverse conditions and simply practicing to be miserable. Find that line and stay away from the misery side. Take care of the soldier's family. His family is his primary concern. So make sure it is one of your primary concerns. When leaders take care of their troops, troops will have trust and confidence in their leaders.

Be technically and tactically proficient. If your troops discover that you don't understand basic knowledge and doctrine, they will lose—or never develop—trust and confidence in you. They will justifiably fear that you will make the wrong decision and get them killed. No one will follow a man who doesn't know what he's doing.

Situational Leadership

The process that I have just described is situational. Much has been said about situational leadership types. Different leaders exercise different types of leadership (authoritative, participative, and delegative) depending on time, people, and the task. These leadership types merely refer to varying amounts of active leader participation in the leadership process. As the situation warrants, some steps of the process are skipped entirely or given less emphasis by the leader.

The authoritative leader makes all of the decisions. He communicates the plan himself and he supervises it closely. He works through the entire process in detail. The participative leader allows his subordinates to make some decisions and partially supervise activities. The delegative leader allows the leadership process to be carried out primarily by his subordinates, while he retains ultimate responsibility and approval authority. However, regardless of the style used, the leader must always define the mission and build the motivational climate.

The situational nature of the leadership process includes leadership at senior levels. A leader modifies his application of the process as he progresses through the ranks—but the basic process remains the same. The senior leader must still decide what to do, how to do it, and then ensure that it gets done. Perhaps the primary difference is that the senior-level leader is unable to get involved in as many details because he heads a much larger organization. There is simply too much to do and he can't do everything—so he must adopt a more delegative style. Consequently, he will spend much of his time defining the mission and setting the goal. FM 22-103 calls this "vision." He must see the big picture and point his unit in the proper direction.

He also cannot supervise every detail of execution but he will still supervise from a distance. Most importantly, he will strive, just as the lieutenant does, to build a motivational climate for his soldiers. In principle, he performs all the same leadership actions as a new lieutenant. But he must do it in a more delegative style.

Leadership Styles

Much has also been said about leadership styles. Leadership style refers to the means by which a leader chooses to build the motivational climate. A positive leadership style uses the positive motivational techniques that I discussed earlier, while the negative style relies primarily on fear and punishment.

The concepts of situational leadership and leadership style are both compatible with the leadership process. They are subsets of the process (Figure 2). Leaders exercise situational leadership when they ask themselves, "how much should I participate in the process?" Similarly, a leader adopts a style when he decides how he will develop the motivational climate.

The Process and Doctrine

The leadership process agrees with the principles laid out in the leadership manuals. But while all of the steps are addressed in current publications, the manuals fail to bring everything together into a single cohesive framework. The leadership process I've outlined does just that.

Figure 3 illustrates the synergism between the process and existing doctrine. First, let's look at FM 22-100, *Military Leadership*. Setting the goal and developing a plan is essentially the manual's "Providing Direction." The manual speaks of "Supervising and Evaluating" and "Providing Motivation." These correspond to the supervision steps, and the motivational climate, respectively. The manual talks about situational leadership in Appendix B. What I have called Leadership Types, the manual refers to as "Leadership Styles." My concept includes a tailoring of the leadership process to account for different motivational levels, supervisory needs, and the decision-making abilities of subordinates.

The doctrine concerning senior leadership is set forth in FM 22-103. Chapter six discusses how to build effective organizations. Delegation and team building are key points. Chapter four talks of the individual skills needed by the senior leader. Technical and tactical competency are the foundation of those skills. This manual separates management and leadership as being two separate entities. As stated earlier, I believe that management is a subset of leadership. The doctrine supports my emphasis on delegation of authority and building cohesive units. The central idea of the doctrinal model of senior leadership is vision. It is the most essential element of that model. While I would agree that vision is a very important concept, I would include the development of the motivational climate as being equally important.

The Process and Existing Doctrine

Leadership Process	*FM 22-100*	*FM 22-103*
1. Goal/mission	Providing direction	Vision
2. Develop a plan	Providing direction	Professional skills
3. Communicate the plan	Factors of leadership and Leadership competencies	Professional skills
4. Supervise	Supervising and evaluating	
Motivational climate	Providing motivation	The organization and Professional ethics

Figure 3

My emphasis on ethical behavior is mirrored in both manuals. However, I believe that ethical behavior is required in order to earn the trust and confidence of your soldiers. It is absolutely essential in building a good motivational climate. The manual does not discuss ethics in this context.

The leadership process fits nicely into existing leadership doctrine. It provides a framework for leadership and tells the military leader how to go about his job of leading. Simply stated, a leader must decide what to do, how to do it, and then ensure that it gets done. It is situational and applies to all leadership types and styles. This leadership process is used by both senior and junior leaders. The situational nature of the process explains the apparent difference between leadership at different levels.

It is the big picture that has been missing from the doctrinal manuals. The leadership process I've presented here—combined with existing doctrine—presents a unified, comprehensive framework of leadership that offers all leaders concrete methods by which to lead our modern Army.

Major Wagner is senior team leader for the Engineer School's Department of Instruction, Engineer Officer Advanced Course division. He previously served as assistant professor of physics at the United States Military Academy. He has also served as a company commander for the 2nd Engineer Battalion, and assistant division engineer for the 2nd Infantry Division. Other assignments include assistant S-3, company XO, and platoon leader. He is a graduate of West Point, Combined Arms and Services Staff School, and Command and General Staff College. He holds a master's degree in physics from the Massachusetts Institute of Technology, and is a registered professional engineer in Virginia and New Hampshire.

(Personal Viewpoint continued)

obstacle systems, a skilled manpower-intensive task, takes far longer than it did formerly. Combat engineer numbers have dropped dramatically—from 24 to 18 platoons. With the loss of the bridge company, the division can no longer haul its obstacle materials. It has also lost the ability to construct anti-tank ditches.

Between the current infatuation with the offense and our engineer "improvements," we can no longer establish a credible defense.

We Must Fix the Problem

The new mine effects simulator, when used with skill, will reacquaint maneuver commanders with the mine threat. We must educate them to the mine opportunity. A combined arms obstacle manual is essential for them to take ownership of an integrated obstacle, fire, and maneuver battle. We must teach maneuver commanders obstacle tactics, and sell them on the importance of obstacles. We must be good—very, very good—at our craft.

We need to change our mine warfare research and development process now! For two decades we have chased the holy grail, looking for an effective scatterable mine system. While the Volcano and the WAM give us an unprecedented capability for situational obstacles and antiarmor ambushes, they are too complex and expensive. We must reserve these systems for special, high-payoff tactical opportunities; we can't afford the quantities needed for run-of-the-mill obstacles.

What we really need is a cheap, effective mine (without bells and whistles) that we can produce and employ by the millions. As a start, we could buy those molded plastic Italian mines, which are a three generation improvement over conventional U.S. mine hardware. An even simpler fix would be to package combat demolitions the same way we package small arms ammunition: two 20-pound containers packed in a case. If the containers were made of plastic instead of metal, with nylon carrying handles and a fuse well molded into the side, they could be converted to mines. A magnetic fuse, which several firms would like to sell the Army today, would make a mine when necessary. This solution is cheap, flexible, and effective.

We need to re-examine our structure under ERI. Reducing the division to two-thirds of its engineers and one-fourth of its digging capability is not an improvement. We have a better command and control structure but have lost the muscle it's supposed to control.

We have peaked on assault mobility—now we must look at our other missions. Desert Storm division commanders bought into and argued for an ERI that had twice the number of engineers they will get under the approved ERI design. They expect the capability they saw in the desert. They need this capability to provide adequate engineer support to the combined arms team for both offensive and defensive operations. We owe it to them!

As the French learned at the start of World War I, focusing only on the attack is a deadly trap. Our Army will eventually learn this as the euphoria of Desert Storm fades. Once again engineers must lead the way—to balance the tactical pendulum.

Colonel Greenwalt is commander of the 937th Engineer Group (Combat) at Fort Riley. He served as regimental engineer of the 1st Infantry Division in Operation Desert Storm. He has also commanded combat engineer companies in Germany, Vietnam, and Fort Polk.

And The Bridge Came Tumbling Down

By Bob Harris

"The opportunity [for engineers] to destroy a standing bridge does not come along often in peacetime."

When the Corps of Engineers decided to demolish an old bridge located in the impoundment area of a new reservoir, they called on Kentucky National Guard sappers to do the job.

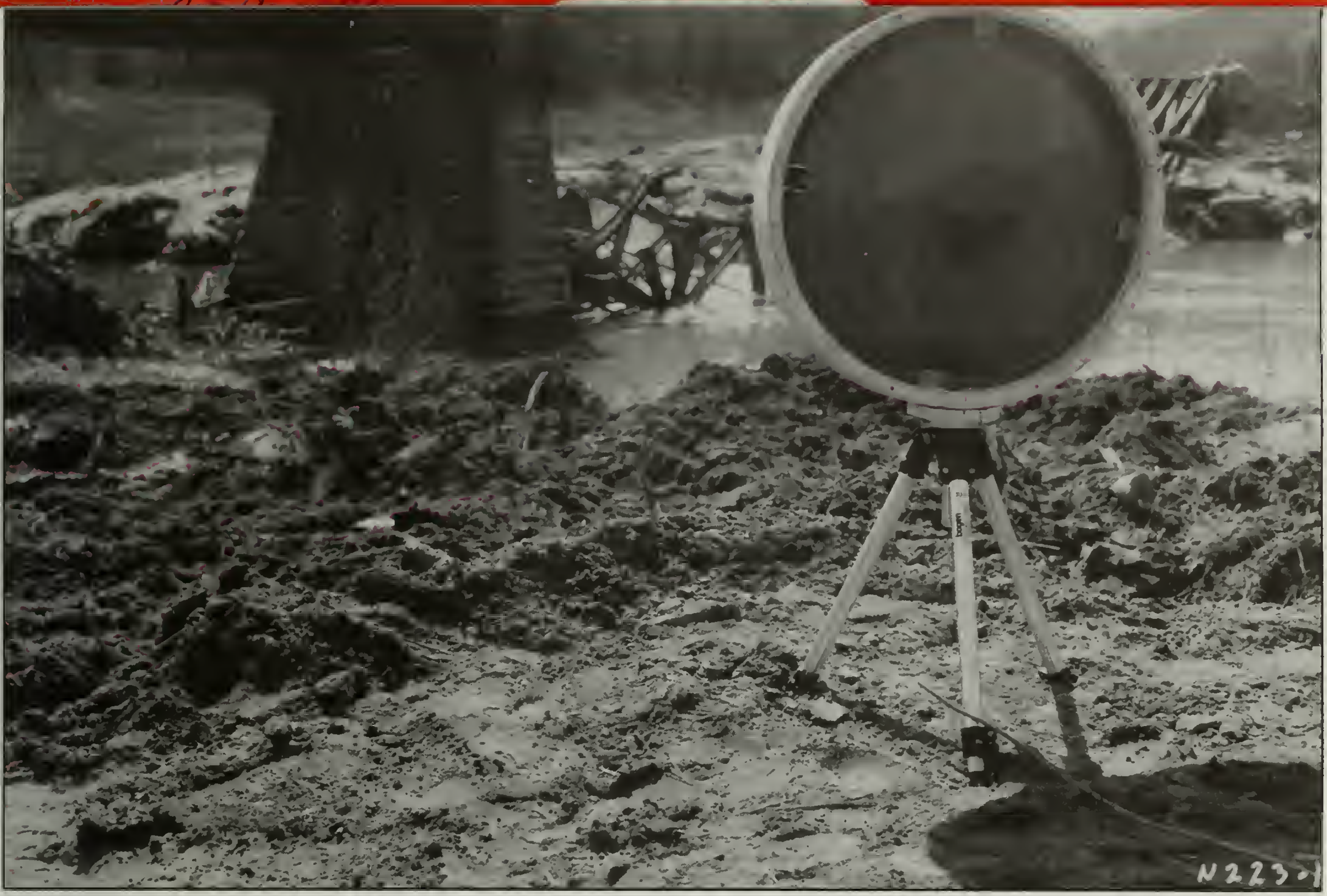
The Carter Bridge in eastern Kentucky was deemed by the Huntington District of the Corps of Engineers as a potential safety and navigation hazard to future boaters on the reservoir.

When asked if demolition of the bridge might provide a good training opportunity for engineer soldiers, the Kentucky National Guard jumped at the chance. The 201st Combat Engineer Battalion from Ashland, Kentucky, was assigned the job of taking down the bridge in March, 1991.

To maximize the bridge's usefulness, it was also decided to use the bridge as a research vehicle for new methods of bridge demolitions. Other players in the project included the Waterways Experiment Station (WES), the Marine Corps, Air Force, Canadian Military Engineers, the Naval Surface Warfare Center (NSWC), and the Engineer School (USAES).

The Carter Bridge was a 242-foot-long, single-lane, steel bridge with one through truss. The substructure had several types of piers, including one steel, two concrete columns, two cut stone piers, one quarried stone pier, and one reinforced concrete pier. The superstructure was constructed of steel stringers with one through steel truss and a wooden deck.

The 201st engineers were given extensive instruction in the Sheffield Method of bridge demolition by experts from the Engineer School's Department of Instruction. The demolition plan called for the bridge to be taken down in four phases. The first was to drop the through truss and cut the steel pier which supported the far shore spans. Next, explosive formed penetrators were used against the cut stone piers and



Above: **One of several explosive formed penetrators (EFPs) used on the bridge's concrete columns and piers. The device, still under development, can cut both concrete and reinforcing bar at the same time (U.S. Army photo).**

Far left: **Sappers from the 201st Engineer Battalion prepare C4 charges to cut the bridge's structural members during the first phase of demolition (U. S. Army photo).**

concrete columns. Phase three called for the use of two 1,000 pound Air Force bombs against the reinforced concrete pier and the quarried stone pier. The last phase was demolition of any remaining structures.

The through truss and steel pier members were rigged with C4, based on the steel cutting formula P=3A/8. To ensure that the truss would drop straight down without hanging up, the sappers needed to produce a clean cut of all structural members.

To do this, each cutting charge was divided in half and offset on opposite sides of the steel beams to produce a shearing effect.

All charges were initiated with an exploding bridgewire cap attached to det cord set up as ring mains. The sappers and other participants took an observation position about 3,000 feet away to view the successful first-phase destruction.

With a slight change in the phase sequence, the sappers employed experimental demolition methods over the next four days against the remainder of the bridge superstructure and piers. Two 1,000 pound Air Force bombs were hand-emplaced by the 201st sappers. One bomb was used against the reinforced concrete pier and one against the quarried stone pier. Each bomb was positioned at an angle and placed at the penetration depth it would be expected to obtain if dropped from an aircraft.

WES technicians used strain gauges, accelerometers, and high-speed cameras to measure and record the destruction of the concrete pier. Additional visual observations were planned, but the explosion threw the entire 10-ton abutment about 50 feet in the air and into the river. Both piers suffered massive destruction from the bomb blasts.

Also tested was a demolition device called the explosive formed penetrator (EFP), which was used against all the remaining concrete columns and piers. Developed by NSWC, the EFP consists of a concave copper disc about a quarter-inch thick. A charge of C4 is packed against the convex side of the disc. On detonation, a copper slug is formed and propelled into the target.

Maximum effective range of the EFP is 100 times the disc diameter, and minimum standoff is one to one and one-half times the disc diameter. The EFPs used on the Carter Bridge ranged from

6 to 22 inches in diameter, using 5 to 33 pounds of C4. This is approximately a 1-to-1 ratio of explosive-to-disc weight. The EFP, which is still under development, is designed to be a stand-off demolition which will cut reinforced concrete. Currently, engineers do not have a fielded munition which will cut both concrete and reinforcing bar at the same time.

Flash flooding during the project added an extra challenge to demolition efforts. High water denied access to the two cut stone piers, so the EFP was employed against the piers from distances up to 75 feet with good results.

The opportunity to destroy a standing bridge does not come along often in peacetime. And the combined efforts of the 201st Engineer Battalion and the other project participants made sure that both training and research were well served when the bridge came tumbling down.

Mr. Harris is a civil engineer for the Engineer School's Combat Construction Division. He previously served as a materials analyst for the school's Directorate of Combat Developments. A retired Army National Guard colonel, he also served as commander of the 203rd Combat Heavy Engineer Battalion, the 135th Engineer Group, and Division Support Command, 35th Infantry Division. He is a graduate of Command and General Staff College, and holds a bachelor's degree in civil engineering from the University of Missouri at Rolla. He is a registered professional engineer in Missouri.

(Engineer Safety continued)

This circular provides information units need to develop a tracked vehicle driver training program. It is essential that our leaders train to and enforce the updated standards and techniques described in this publication.

For an accident prevention plan to be successful, operators and supervisors must become familiar with the hazards associated with vehicle. In this case, we can link the hazards to specific parts of the human anatomy.

Head. We'll begin with the head, the body part that receives the most injuries during M113 accidents. Soldiers bruise, lacerate, and suffer contusions to the head when they are thrown about during an accident sequence: when the vehicle rides over bumps or comes to a sudden stop. Rollover accidents are the major cause of fatal head injuries. Unsecured hatches are another significant cause of head injuries.

Preventive measures include:

- Enforcing speed limits
- Enforcing the use of safety belts
- Ensuring that passengers and crew members wear helmets and know imminent roll-over procedures
- Ensuring supervisors inspect the positive locking safety latch on all hatches before and during vehicle operation

Back and Neck. Many back and neck injuries are caused by the same factors that contribute to head injuries. Soldiers who connect or disconnect trailers to the M113 are also prone to back injuries. In addition to the preventive measures listed above, proper supervision and ground guides can help prevent these accidents.

Back and Rib Cage. Soldiers who occupy the tank commander position receive back and rib cage injuries when the vehicle comes to a sudden stop or drives over rough terrain. Speed control, route awareness, and use of safety belts will prevent most of these injuries.

Arms, Hands, and Fingers. Most arm, hand, and finger injuries are caused by unsecured hatches. Soldiers who perform maintenance such as installing, removing, or assembling parts on the M113, also injure these body parts. Preventive measures include protective equipment such as gloves and goggles, proper planning before starting a mission, using the correct tools for each task, proper supervision, and checking and rechecking hatches to ensure they are secured.

While the above factors account for most injuries, some soldiers who were not passengers or crew members have been maimed by the M113 APC. For example, some dismounted soldiers elected to assume hasty fighting positions in the path of an M113, and some fell asleep in areas trafficked by these vehicles. Such needless and tragic accidents can be avoided if units use ground guides in bivouac, cantonment, and motor pool areas; plan actions during unexpected tactical halts; and brief soldiers about selecting safe sleep areas.

Army safety statistics show that the Engineer Branch has successfully integrated safety into most day-to-day operations. But we must not rely on our record. We must continue to incorporate safety in all that we do. Commanders and supervisors must continue to ensure that unit-level training occurs regularly and that operators, instructors, and crew members meet the standards provided in FM 21-17 and TC 21-306. They must concentrate prevention efforts toward educating soldiers about equipment hazards and the countermeasures needed to ensure safe working conditions.

Captain Miguel Torres is the Engineer Branch Safety Manager at Fort Rucker.

ENGINEER UPDATE

Autovon numbers are 676-XXXX and commercial numbers are (314) 563-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

1992 Senior Engineer Leaders Training Conference (SELTC) Planned. The 1992 SELTC for Active and Reserve Component senior leaders will be held on April 21-25 at the Engineer Center. A District Commanders Conference is scheduled for April 21-22; registration begins on April 20. SELTC activities will be on April 23-25, with the Regimental Dinner on April 24. Invitations will be mailed early in February. POC is MAJ Joseph Schuessler, -5335.

Topographic Master Plan Published. The coordinating draft of the "Army Topographic Master Plan" is scheduled for distribution in February 1992. This plan will be the base document used to develop topographic support to AirLand Operations, assess our capability to provide topographic support, and identify solutions to deficiencies through the doctrine, training, leader development, organization, material, or soldiers (DTLOMS) process. POC is LTC Schnabel, -5435.

Military Qualifications Standards (MQS) Update. Students attending the Engineer Officer Basic or Advanced Courses (EOBC and EOAC) or the Command General Staff Officer Course (CGSOC) will be required to verify their proficiency on MQS. A trial program to verify MQS I (Pre-Commissioning tasks) began in EOBC class 2-91. A test to verify MQS II - Tier I (lieutenant tasks) is scheduled to begin with EOAC Class 6-92 (22 May 1992). CGSOC engineer students participated in a test of MQS II - Tier II (captain tasks) in December 1991. The Engineer School will analyze test results and make necessary revisions. References are:

- STP 21-I-MQS *MQS I Manual of Common Tasks (Pre-Commissioning Requirements)*, May 1990
- STP 21-II-MQS, *MQS II Manual of Common Tasks (For Lieutenants and Captains)*, January 1991
- STP 5-21-II-MQS, *MQS II Engineer (21) Company Grade Officer's Manual,* March 1991

The Combined Arms Command is developing an MQS III (field grade officer) common task list. POC is CPT James Price, -7787.

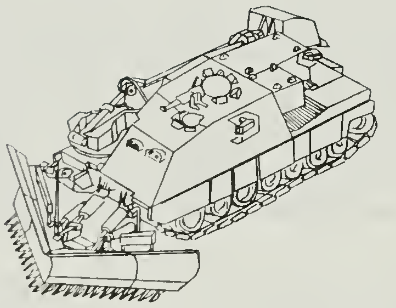
Combined Arms Training Strategy (CATS). Resident training for CATS will reflect training as it exists at Fort Leonard Wood. This strategy will provide unit commanders with a single source document listing the tasks and standards to be trained. It will also show specialized training, such as MILES, a soldier or officer received here. August 1992 is the target date for submission of

CATS resident training to the Combined Arms Command (CAC). They will review all submissions and determine a plan for fielding CATS. POC is CPT James Price, -7787.

Fratricide Prevention. As a result of experiences in Desert Storm, the Engineer School is part of a TRADOC/AMC team tasked to address casualties by "friendly fire." The school position is that engineer forces inflict fratricide primarily through mine warfare. The school is reviewing doctrinal and training materials that influence the control, reporting, recording, and marking of friendly minefields, especially scatterable mines. Changes to doctrine will be included in school instruction and in the next revisions of MTPs, FM 20-32 (FY 92), and FM 5-102 (FY 93). POC is CPT Bruce Chesne, -7784.

Directorate of Combat Developments (DCD)

Heavy Assault Bridge (HAB) and M1 Breacher. The HAB and M1 Breacher have been designated as project managed systems, acquisition category III. The HAB program will develop an MLC 70 bridge (24 meter gap crossing capability) on an M1 chassis. Initial operational capability (IOC) for the HAB is FY 97. The M1 Breacher will have the capability to breach complex obstacles. It will have a full-width mine-blade with automatic depth control, a power-driven arm, and a 2-man crew. IOC for the M1 Breacher is FY 97. Both vehicles will have the mobility, survivability and supportability of the M1A1 main battle tank. POC is CPT Ted Rausch, -7339.



M-1 Breacher

VOLCANO Fielded. The 13th Engineer Battalion, 7th Infantry Division, was the first unit to receive the VOLCANO, on 6 December 1991. Light engineer units in the XVIII Airborne Corps will receive the system and 5-ton dump truck mounting hardware during the remainder of FY 92. Heavy divisions will receive the system with M548 mounting hardware in FY 93-94. Aviation units will receive the system with UH-60 mounting kits in FY 95. Systems will be fielded to the rest of the Army in FY 96-98. POC is Mike Bonomolo, -7978.

Engineer Personnel Proponency Office (EPPO)

Warrant Officer Management Act (WOMA). New legislation that provides a life-cycle management system for warrant officers becomes effective in February 1992 (see article, page 21). The system has four major components: a single promotion system, management by years of warrant officer service, selective early retirement, and promotion to Chief Warrant 5. WOMA will offer full career potential to all warrant officers and provide the Army with enhanced readiness based on a better qualified, more experienced warrant officer force. POC is CW4 Bobbie Campbell, -5353.

Project Warrior Opportunities. Engineer officers and NCOs who participate in Project Warrior will spread the expertise learned as observers/controllers at combat training centers (CTC) to the rest of the force. After 2 years at a CTC, Project Warrior participants are assigned to their branch school, where they add current warfighting experience and practical application of doctrine to the instruction of junior leaders. Engineer captains serve as tactics and training instructors, EOAC small group instructors, or engineer combat operations doctrine writers at the Engineer School. Engineer NCOs (SSG/SFC) are assigned as instructors at the Libby Non-Commissioned Officer Academy or as EOBC platoon trainers. Contact your assignment personnel for more information about this challenging program. POC is CPT David Kramer, -5362.

Engineer Branch Safety Office (EBSO)

Army To Cease Using Halon. The Secretary of Defense has directed that the Army stop using Halon as a fire suppressant. Halon must be completely eliminated from the Army inventory by October 2000.

Units are directed to immediately stop the practice of bleeding fire suppressants into the atmosphere while performing maintenance. Beginning in July 1992, penalties will be imposed on units that do not comply with this directive. POC is Mark Totzke, -7346.

Safety-Of-Use (SOU) Messages. A study conducted by the Armor School indicates that SOU messages often are not received on a timely basis. Recent SOU messages are:

- TACOM 91-26 (29 Nov 91) Towbar, motor vehicle, NSN 4910-00-433-7094, procured under contract DAAA09-81-C-4279. Use should be discontinued immediately. Company commanders should contact their TACOM LAR for further instruction.
- MEP-24-91 (26 Nov), Model 2500 L Firetruck, NSN 4210-01-193-3621 (limited one-time inspection). Possible fuel leak in the WEBASTO heater. POC is Gary Horton, AMSTR-MEPP, DSN 693-9396.

Safety Video Tapes. Units can use two new video tapes to upgrade their safety training programs. Both tapes focus on the leader's role in promoting safety awareness, and are available at local Training and Audio-Visual Support Centers (TASC):

- "Reducing Risks in Training - Its Nobody's Fault," PIN 706456, TVT 20-932.
- "Maintenance Safety," PIN 706034, TVT 20-933.

POC is Paul Rusinko, -5002.

Reserve Component (RC)

EOAC-RC Program Changes. Officers are still required to take all four phases of EOAC-RC. Officers who have not taken the Common Core (Phase IIA) from Fort Eustis as of 1 October 1991, must take Phase I, CAS3-RC, from Corresponding Studies at Fort Leavenworth. To enroll, send a DA Form 145 to Commander, USACGSC, Attn: ATZL-SWE-R, Fort Leavenworth, KS 66027-6900. A new two-phase program is scheduled for FY 93.

Officers who have completed the Advanced Course from another branch must take three phases of EOAC-RC. Normally these are Phase I: Company Command Module, Phase IIB: Engineer correspondence, and either Phase IIIA: Combat Engineer or Phase IIIB: Sustainment Engineer.

There is a change concerning Phase I. An officer who has had two years of successful command is no longer required to take Phase I, if his rater sends us a memo stating that he had two years of successful command. That is all the memo needs to say; no details are required. Upon receipt of this memo, the officer will take Phases IIB, IIIA, and IIIB. Address memos requesting this exception to policy to: Commander, USAES, Attn: ATSE-ESR, Fort Leonard Wood, MO 65473. POC for USAR is COL Shoff, -6336. POC for ARNG is LTC Juneau, -7742.

News and Notes

Soldier Hotline Established. A new hotline at Fort Benning gives soldiers and commanders a voice in deciding the equipment they will use in the field. Recommendations to improve battlefield capabilities of lethality, command and control, survivability, sustainment, and mobility are requested. To make recommendations, call (404) 545-1245 or AV 835-1234.

Blaster's Training Seminar. A Blaster's Training Seminar is scheduled for 24-26 February, 1992, at the University of Missouri-Rolla. The seminar includes 20 hours of instruction. For more information, call (314) 341-4317.

Senior Officer Logistics Management Course (SOLMC). SOLMC offers commanders and primary battalion- and brigade-level staff an opportunity to update their knowledge in the logistics arena. The one-week course at Fort Knox encompasses maintenance, supply, and transportation procedures, and hands-on experience with vehicles, weapons, ammunition, medical, communications, NBC, and quartermaster equipment. It is open to officers in grade of major or above in the active and reserve Army, US Marine Corps, and allied nations; and civilians in grades GS-11 and above. For information, call (502) 624-7133.

The Evolution of Engineer Officer Education

By Dr. Martin Reuss

"The Corps of Engineers is a product of the West Point Military Academy." So begins chapter one of Arthur Morgan's polemic against the Corps, *Dams and Other Disasters*. Morgan's assertion is not far off the mark. West Point's educational system has profoundly affected both the professional approach and general outlook of engineer officers, who historically came from the top 10 percent of each graduating class. Except for those Chief Engineers who were already in the Army when West Point was established in 1802, all Chiefs of Engineers in the 19th century, and all but two in the 20th century (Reybold and Pick) have been alumni of "the Point."

However, it is also true that an engineer officer's professional advancement depended on showing mastery of many subjects learned in military and civilian institutions after graduation from West Point. These subjects included civil works, military construction, and combat engineering. The aim was to produce an officer who showed management and leadership abilities and had substantial engineering skills that could be used in a wide variety of peacetime and wartime missions.

Today, as the Army is being reshaped in response to changing geopolitical and economic realities, it is important to recall that historically the education of engineer officers has always striven to identify those who were both talented and flexible enough to work in many different environments.

What sort of education did early West Point cadets receive? In the early 19th century, it was definitely an education based on Franco-Italian theory and technical literature. Of the 943 books in the West Point library in 1822, 63 percent were in French. Of the engineering books, 82 percent were in French. "All the cadets at the end of the second year read French with facility," wrote Major Joseph Totten of the Corps of Engineers in an 1821 letter. "The French stand so confessedly above all their neighbors in many departments of science (that) it is unquestionably necessary to reach thus far."

True to the French approach, West Point cadets spent much of their academic life studying mathematics. In 1823, 36 out of a weekly total of 54 hours of study were devoted to mathematics in the first and second years. Basic engineering was learned from a limited number of texts, at first entirely French. An 1824 West Point regulation put engineering and the science of war into a single course that embraced field fortification, permanent fortification, science of artillery, grand tactics, and civil and military architecture. Included in civil and military architecture were canals, bridges, and other public works. Beginning in 1827, with Dennis Hart Mahan's *Elementary Course of Civil Engineering*, cadets used some textbooks written in the United States.

At the end of the 19th century, mathematics remained the major subject during the first two years at West Point. Cadets studied military engineering in years two and three and for half of the final year, when it shared equal time with civil engineering. That half-year civil engineering course was the cadet's sole exposure to the subject.

At the end of the half year, each student needed to pass an oral examination, at which time the instructors also graded various engineering drawings. Should a student fail this examination, he might be required to take a written test. Generally, the examination was considered "doubtful" if a student failed to achieve two-thirds of the total mark.

For most young engineer officers after the Civil War, postgraduate education began at the Engineer School of Application, which was established at Willets Point, New York, in 1866. There, West Point graduates had an opportunity to command a company of enlisted men (three to five companies were in the engineer battalion) and to hone skills learned at the academy.

Most of the work conducted at Willets Point dealt with combat engineering problems and submarine mining, although surveying and tidal and current measuring received some attention. Normally, officers spent approximately two and one-half years at Willets Point.

Class of 1904 West Point cadets working with models (U.S. Army photo).

In 1901, the school was moved to Washington Barracks (now Fort McNair), in Washington, D.C. There young lieutenants took courses in "civil engineering, lighthouse construction, mechanical and electrical engineering, seacoast defenses and permanent fortifications, including land defenses of important harbors." The school was officially renamed The Engineer School in 1904. After World War I, it was moved to Camp Humphreys, now Fort Belvoir, Virginia.

In 1909, the part of the Engineer School curriculum that applied to the mobile Army was transferred to the newly established Army Field Engineer School, at Fort Leavenworth. The purpose of that school was to instruct engineer officers in their military engineering responsibilities and to provide military engineering instruction to Army Service Schools.

A department of engineering offered courses in such fields as mapmaking, field fortifications, lines of communication, and the organization, duties, and equipment of engineer troops. The department of military art taught tactics, military history, conduct of war, horsemanship, and current military issues. The language department offered a required course in Spanish (the United States had gained several Spanish-speaking possessions following its victory in the Spanish-American War, and engineer officers were working in the Panama Canal). If a student already knew Spanish, he was required to take French or German. The Field Engineer School was transferred back to Camp Humphreys in 1920, and its courses were reincorporated into the curriculum of the Engineer School.

Beginning in the early 1920's, the Corps began sending young officers with high potential to outstanding universities and colleges to further their engineering education. In this country, MIT, Cornell, University of California, Berkeley, and Iowa were the preferred universities for civil engineering. Some fortunate and highly talented engineers could pursue their education abroad, often at outstanding universities in Germany.

Until the onslaught of public works projects during the New Deal years, a West Point graduate had a long wait before being given control of a river or harbor project.

Nineteenth century West Point classroom scene (U. S. Army photo).

In the immediate post-Civil War period, he was expected to go first to the School of Application. Then he served as an assistant engineer for several years to gain practical experience. Only after attaining the rank of captain and passing some difficult promotion examinations was he given charge of a public works project. An officer often did not gain this opportunity until he had been out of West Point for nearly 15 years.

In 1909, the normal officer career progression was changed slightly. After graduating from West Point, each engineer officer immediately joined an engineer district to gain practical experience under the engineer officer in charge. The Corps tried to arrange it so that each new graduate spent some time working on the Panama Canal, on breakwater or jetty work, and on river improvements. In each case, the officer was expected to write a "descriptive memoir upon the works observed, which shall include a comparison of the theory and practice of the work under observation." The Engineer School Board reviewed these memoirs and gave an officer school credit if his memoir was deemed satisfactory.

When reporting to his first duty station, a lieutenant was expected to bring with him about half a dozen books prescribed by the Chief of Engineers that pertained to activities in that region. These might include B.F. Thomas and D.A. Watt, *Improvement of Rivers*; L.F. Vernon Harcourt, *Rivers and Canals*; William Starling, *Floods of the Mississippi River*; and Mansfield Merriman, *Treatise on Hydraulics*. The District Engineer could modify the reading assignments to accommodate requirements of the lieutenant's assigned projects.

After a year's exposure to the full range of civil works activities, a lieutenant attended the Engineer School at Washington Barracks. After completing those courses satisfactorily, he was assigned to civil works and military duty as an assistant to more senior officers. A young officer spent at least four years with engineer troops and at least one at the Army Field Engineer School. Only after this time could he expect to receive the rank of captain and be given authority over a civil works project.

Promotions were agonizing. A promotion board examined each candidate orally for at least 6 hours and sometimes for more than a day. The board examined the candidate's notebooks and memoirs and assigned a memoir subject for the candidate to complete within a week. The officer had to pass all phases of the examination. If he failed, he could not be re-examined for a year. A second failure ended in discharge from the Corps.

Exact procedures and subjects covered in the examinations changed over time. Generally, in the period between the Civil War and World War I, the examining board inquired about the manner in which an officer discharged his duties, his Army school record, and his familiarity with technical literature.

For promotion to first lieutenant, the officer might be examined on various West Point textbooks, astronomy, familiarity with various instruments, field reconnaissance, methods of administration and construction, and disciplinary and drill procedures. For captain, he needed to know about coast and harbor defense, principles of civil engineering involved in river and harbor improvements, surveying, and if he had served with troops, something about their duties and engagements. To become a major, the candidate could be examined on any of the above subjects and was expected to know about the organization of armies, especially engineer forces in the field, show familiarity with modern American and European military literature, and have some knowledge of the important features of the Civil War. While the board usually did not question the officer on all subjects, the candidate had to prepare for all possibilities.

If West Point was the first step on the military career ladder, the other steps fell into obvious place for junior engineer officers: attendance at the Engineer School, learning practical engineering at the district level, perhaps publishing some articles, command experience over engineer troops, attendance at a top-notch engineer college and Fort Leavenworth, and passing the promotion board examinations. In the end, an engineer officer had not only obtained a respectable engineer education (a process which West Point only began), but also had learned to be a manager.

Today the Corps of Engineers prides itself on its ability to manage all kinds of engineering activities, from the smallest to the biggest and very expensive macro-engineer projects. This pride and capability are the natural consequences of more than 175 years of Army engineer education.

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BRIDGE THE GAP

By Command Sergeant Major Richard N. Wilson
U.S. Army Engineer School

Flexibility and the ability to respond to unexpected events are crucial components of every noncommissioned officer (NCO). As leaders, we must provide the training our soldiers need to build the skills and techniques they will use to survive in an increasingly complex environment. Our job is to develop new leaders—soldiers who have pride in our Army, trust and confidence in their abilities, and the will to win against any odds.

Leader development is critical for the future of the Corps of Engineers and is one of the most important challenges facing us today. To develop high quality new leaders, we must first build competent warfighting and leadership skills. We must understand the importance of leader development and provide the support and emphasis needed to sustain it. And, we must develop an all encompassing program for training that will guide and assist every NCO throughout his or her career.

Leader development for NCOs is structured around three pillars: institutional training, operational assignments, and self-development. Each pillar plays a critical role in an NCO's professional development.

Institutional training, the first pillar, focuses mainly on the NCO Education System (NCOES). It begins with the Primary Leadership Development Course and culminates with the Sergeant Majors course. Other programs of instruction, such as the Battle Staff Course and First Sergeants Course, provide excellent training within the institutional development process.

A primary component of successful institutional training is our ability to select the best NCOs to attend these courses, and to ensure that those selected are fully prepared and motivated to attend and complete them. During this period of shrinking resources, we must ensure that every training dollar is spent wisely. Unfortunately, we still find instances where NCOs who are overweight, can't pass the Army physical fitness test, or have some other disqualification, report to NCOES schools. This is totally unacceptable! As leaders, we must do better in this area.

The second pillar, operational assignments, provides opportunities for leaders to refine skills, broaden knowledge, and shape attitudes gained in institutional training. These assignments provide NCO leaders with opportunities to gain on-the-job experience that prepares them for progressively more difficult duty positions.

To fulfill this part of the development process, we must make NCO leader development a priority unit mission. We must clearly define and expand duty position requirements and be actively involved in assigning the best qualified NCOs to progressively more difficult duty positions. We must be creative when developing assignments, and find ways for NCOs to build the skills needed to respond to unexpected situations. We must mentor subordinate NCO leaders, accurately access their performance, and be honest and constructive when counseling them.

Each unit must prepare and implement a developmental program for their NCOs that supports the unit's mission and prepares them for future assignments. This program should point NCOs toward the third pillar: self-development.

Self-development works hand-in-hand with the other pillars. It does not happen in a vacuum. Every NCO must demonstrate the motivation and ability for self-development. But, we cannot expect our soldiers to develop themselves unless we provide an honest assessment of their abilities and potential through mentorship and counseling.

We must all accept the challenge to improve our leadership abilities. And we must challenge others by helping them establish a course of action for their self-development. We must encourage our NCOs to prepare for self-development tests (SDT) and to improve their technical competence through military and civilian education. Taking the Test of Adult Basic Education (TABE) enables an NCO to establish a starting point from which he or she must work.

Let us make leader development our primary mission for 1992. I challenge each of you to prepare and implement a leader-development plan for your unit.

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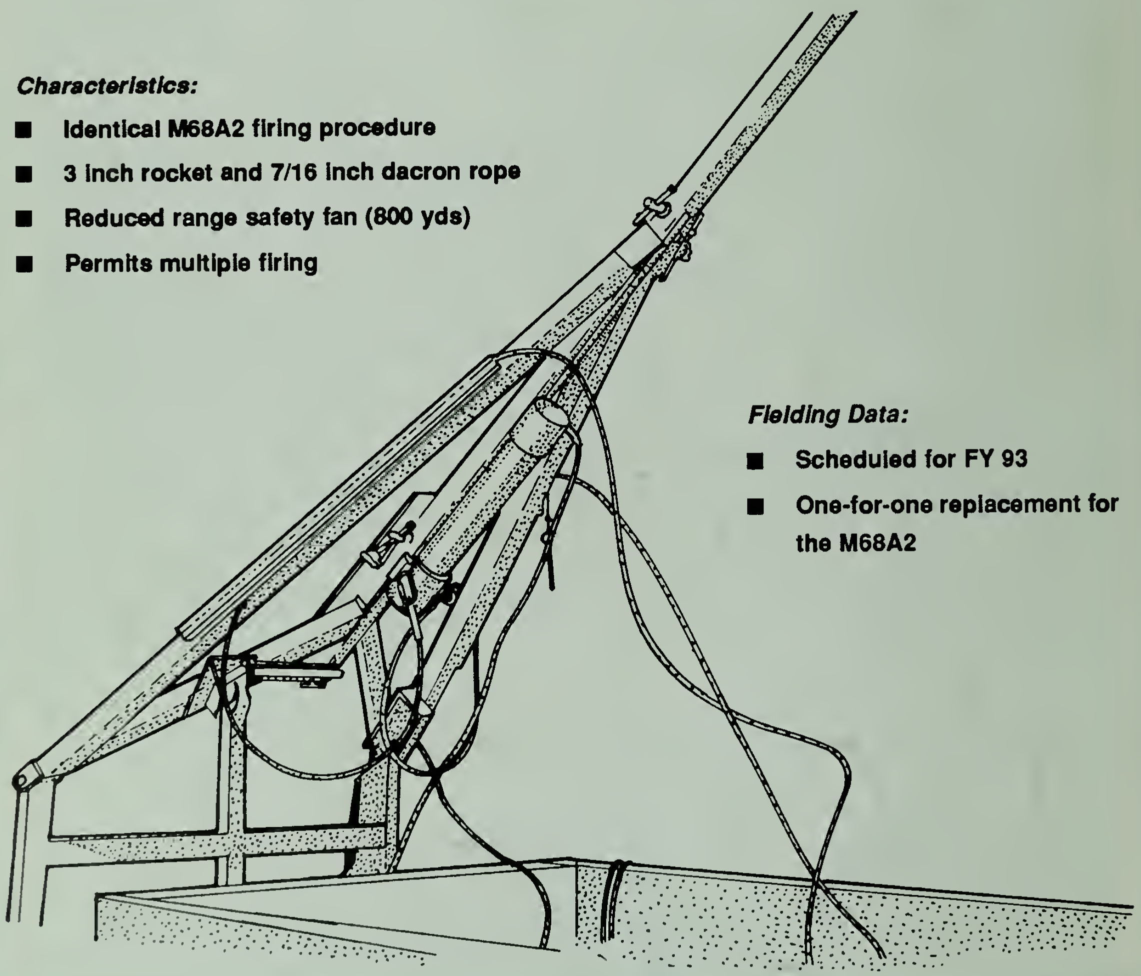

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Headquarters, Department of the Army
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NATION ASSISTANCE

PB 5-92-2

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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

In the last three years the world has undergone the most significant changes since the end of the Second World War. As the international environment evolves, so, too, do the United States's national objectives abroad. This evolution, in turn, impacts on the operations of the U.S. Army.

The focus of this issue of *ENGINEER* is "nation assistance"—a term used to describe the concept by which the Army supports the U.S. Government's efforts to assist other nations and promote international stability. Major Hauck's article, which begins on page 11, explains nation assistance in general terms. As he states, nation assistance is not a new mission for the Army—we have conducted it throughout our nation's history. But the evolving strategic environment has caused us to take another look at this concept as a method for employing forces (as opposed to using force) to reduce the likelihood of international violence and conflict.

Other articles address specific nation assistance activities undertaken by engineers in the field. These articles reflect the diversity of nation assistance-type operations, ranging from postwar reconstruction in Kuwait to Civic Action Team missions in Southeast Asia.

The recently published 1992 *National Military Strategy* reflects the monumental changes occurring throughout the world. This document contains the Chairman of the Joint Chiefs of Staff's input to the President and Secretary of Defense for their use in preparing strategic guidance for the armed forces. It identifies several forces that are currently changing the strategic security environment. They include, among others, the continuing struggle to improve human conditions throughout the world; the march toward democracy in Eastern Europe, Latin America, and other parts of the world; and drug trafficking. These forces highlight the fact that our nation is now considering challenges very different from traditional cold-war threats. While strategic planners have addressed those issues in the past, their relative importance has increased enormously. Recommend that you read the new *National Military Strategy* document. It's short, but it provides an invaluable perspective on evolving national strategy.

The Combined Arms Command, at Fort Leavenworth, continues to work on the revision of FM 100-5, *Operations*. The revised manual will expand, rather than change, doctrine in the 1986 version. This expansion is the result of several factors, including the evolving strategic environment addressed earlier. Other factors include changes in technology, lessons learned from recent military operations, and recognition that our doctrine must better address strategy and operational art, as well as their linkage to tactics.

As Leavenworth develops the new *Operations*, we at the Engineer School will begin revising FM 5-100, *Engineer Combat Operations*. Engineer doctrine will keep pace with that of the rest of the Army, so that we can continue to provide the best possible support as active members of the combined arms team. It's truly an exciting time to be a soldier and an engineer!

The 1992 Senior Engineer Leaders' Training Conference, or SELTC, gets underway about the same time that this issue of *ENGINEER* is published. The theme of this year's conference, "Shaping the Force for the 21st Century," is a subject of great interest at all levels of the Total Army. Those who attend the conference will hear presentations by the Chief of Staff of the Army, the Chief of Engineers, the FORSCOM and TRADOC commanders, and the Deputy Commander in Chief, U.S. Army Europe. As always, SELTC provides an opportunity for the Army engineer community to come together to share ideas, renew old friendships, and build new ones. Hope to see you there!

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Cover : In the aftermath of the Gulf War, workers repair high power lines south of Kuwait City. (Photo by Jonas Jordon, SASPA, U.S. Army Engineer District Savannah)

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Nation Assistance in Kuwait

By Brigadier General Ralph V. Locurcio

In the aftermath of Desert Storm, the U.S. Army Corps of Engineers played a central role in reconstructing Kuwait's infrastructure. The mission of reestablishing life support systems that provided for the safety and security of Kuwaiti citizens was a successful one, and may well be a model for the future. That is, American military assistance to third world countries, followed by nation assistance to restore internal security and enable reform, or preferably, nation assistance in lieu of military assistance to accomplish similar objectives. What follows is an analysis of engineer activities in Kuwait that can be applied to future nation assistance operations.

Background

Anticipating extensive devastation from the Iraqi occupation and subsequent combat action, the Emir of Kuwait formed a government committee known as the Kuwait Emergency Recovery Program (KERP) to manage recovery operations. With functions similar to the Federal Emergency Management Agency (FEMA) in the United States, the committee was headed by Dr. Ibrahim Al Shaheen, who was later named a national minister.

After considering several private contractual options, Dr. Shaheen advised the Emir of Kuwait to ask President Bush for recovery assistance from the Corps of Engineers, with all costs to be reimbursed by the government of Kuwait. The Corps had recent experience in natural disaster recovery after Hurricane Hugo and the San Francisco earthquake. Additionally, it had extensive experience working in the Middle East, along with knowledge of the construction environment and culture. Dr. Shaheen and his advisors assumed that Corps professionals could just as successfully apply their expertise to the devastation wrought by a military disaster. They were right.

On January 14, 1991, as the air attack began and plans for the ground attack to liberate Kuwait were being finalized, the Corps signed a $45 million Foreign Military Sales (FMS) agreement with Kuwait to begin the process of assistance. The Corps launched the recovery operation from its Transatlantic Division Office in Winchester, Virginia, formerly known as the Middle East/Africa Projects Office, which also provided command, control and logistical support throughout the operation.

Following the liberation of Kuwait in February, the recovery task force, dubbed the Kuwait Emergency Recovery Office (KERO), moved into Kuwait from a staging area in Saudi Arabia. Once in Kuwait, KERO operated under the local direction of the Defense Reconstruction Assistance Office (DRAO) which, in turn, reported to the Department of Defense (DOD) and the U.S. Ambassador to Kuwait for guidance and direction.

The KERO team entered Kuwait on March 4, 1991, to commence recovery operations. In the 300 days following liberation, this team, which averaged 140 American and 60 Kuwaiti professionals, placed over $300 million in repair work through contracts with major American and foreign construction firms. Working seven days a week and an average of 12-14 hours per day, they surveyed, repaired, and restored to operation major infrastructure systems and facilities such as the national network of 300 kilovolt (kv) electrical distribution lines.

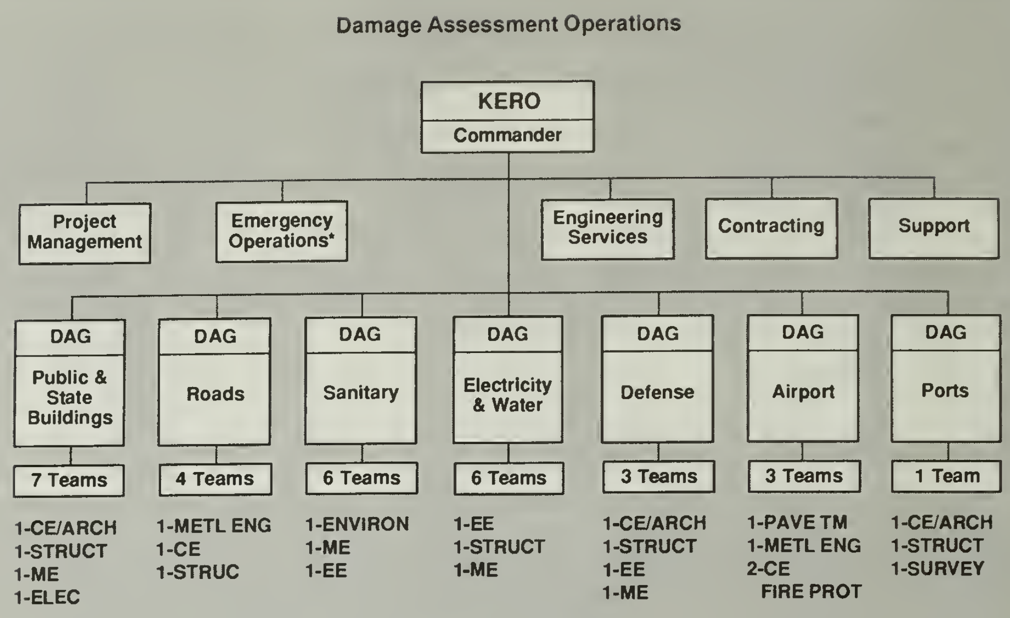
They also worked on electrical substations, water mains and pumping units, the highway network, sanitary mains, two seaports, the international airport, and more than 150 public schools. Other projects included over 750 public buildings, including police, fire, medical, other service facilities, ministerial headquarters and some defense facilities. The details of the scope and magnitude of this successful operation have been reported in several accounts by national and international media.

What is more important for our Army today, considering the likelihood of future nation assistance operations, is an account of the major

"A nation assistance task force cannot operate in a vacuum—even though...constrained by time..."

Above: Jim Wong, Army Corps of Engineers, and Suhaila Marafi, a Kuwaiti engineer, inspect electrical damage at Ali Al-Salem Air Base. (Photo by Jonas Jordan)

Far Left: Eman Qaturba, a Kuwaiti observer and Captain Bob Irby inspect power cables damaged by cluster bombs south of Kuwait City. (Photo by Jonas Jordan)



*Provides primary direction during "recovery" phase.

Figure 1

decisions and processes which governed assistance operations in Kuwait. This article will deal with these subjects. In particular, the following will be covered:

- Organization and staffing of KERO
- Programming and budgeting for the recovery
- Contracting
- Logistics
- Political factors and partnership with the host nation

Staffing

In the case of the KERO operation, there was not much time to organize, staff and train the initial task force of approximately 140 Corps employees. These personnel were experienced volunteers from various districts and divisions, who rotated to Kuwait on a three-month cycle. To minimize potential dysfunction and confusion caused by an unfamiliar organizational structure, a decision was made to use the habitual Corps organizational structure for a small district office.

In short, volunteers from various Corps organizations would hopefully arrive in KERO and be comfortable with the working environment with only a situational orientation and very little training. Following this basic premise, KERO used two structural variations, each suited to the particular operations at the time, but both employing a common district headquarters structure.

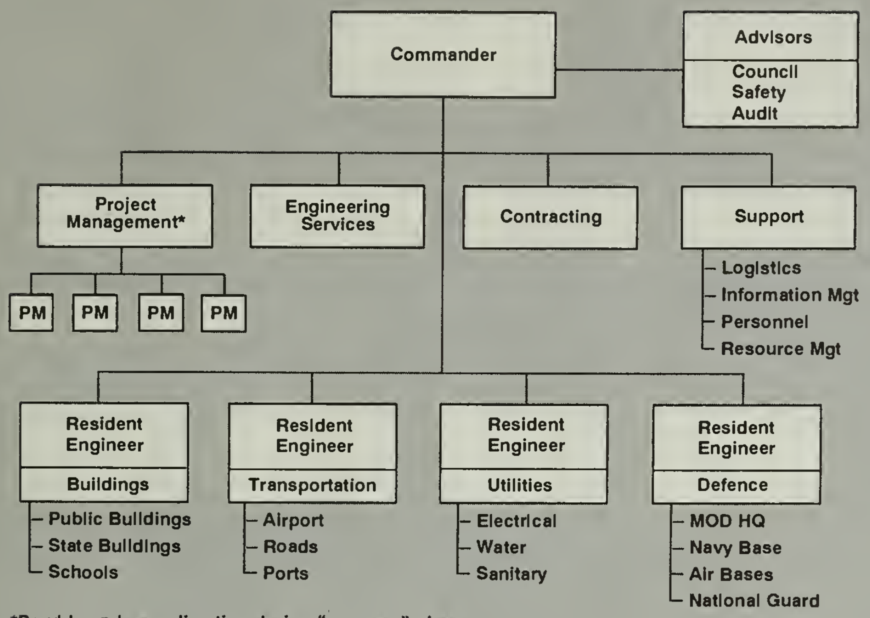
During the initial survey phase of the recovery, KERO field offices were set up according to Corps Emergency Management practice. Labeled Damage Assistance Groups (DAGs), each had a variable number of assigned Damage Assistance Teams (DATs), depending on the mission of each group (Figure 1). For simplicity, DAGs were aligned with specific Kuwait Ministry sectors: buildings, roads, airport, electricity, water, ports, defense, and so on, according to prewar Kuwaiti management conventions.

Adoption of these conventions simplified interface with the host nation because it made leaders and volunteers from these Kuwaiti ministry sectors readily available to work with KERO. This structure was used for about 45 days while damage survey reports (DSRs) were being completed and contractors were mobilizing. Actual construction during this time was minimal.

During the subsequent recovery phase, when construction management became the dominant operational consideration, a more conventional Corps project management structure, with traditional resident offices to manage contractors in the field, was adopted (Figure 2). This helped ensure that project delivery and contract administration were accomplished according to the Corps' quality standards.

Project managers (PMs) were assigned to each ministry sector in order to coordinate with the appropriate Kuwaiti officials responsible for that sector. Managers were tasked with developing a program for each sector in order to control all projects for that sector, from concept to turnover. For example, all roads projects

KERO Organization



*Provides primary direction during "recovery" phase.

Figure 2

constituted the "roads sector program," which was the responsibility of one PM, who worked with the Kuwaiti official responsible for roads.

The PM established project priorities, developed project and program budgets, and decided project features and quality standards. Each PM also monitored progress through all technical phases (design, contracting, construction), reported on the progress of each project and the entire program, and supervised eventual project turnover.

Purely technical phases of the project life cycle were handled by the appropriate technical divisions within the KERO structure: Engineering Services (analysis, design, estimating, specifications, value engineering, field consultation); Contracting (contract preparation, solicitation, review, award, small business administration), and Resident Offices (construction management, contract administration, modifications, claims resolution). Other professional elements such as counsel, safety, and audit were also present on the KERO team to round out the professional package and ensure timely project completion.

All of these decisions proved to be correct and advisable for future operations, but there were a few problem areas. For example, the conversion from DAGs to Resident Offices proved somewhat problematic as new roles and responsibilities were sorted out. Similarly, the decision to rotate field level engineering professionals every three months was a difficult—but workable—staffing concept.

On the other hand, rotation of key leaders such as deputies, division chiefs, resident engineers, the chief of project management, the resource manager, and the property book officer, proved extremely disruptive. In future operations, key personnel should be selected for the duration of the operation, or not less than a six-month tour with a minimum overlap of at least one week.

Programming and Budgeting

When KERO began its work, there were no operational governmental agencies in Kuwait to accomplish the normal budgeting actions necessary to fund a large-scale national reconstruction program. It didn't take long for KERO to obligate or expend the original $46.3 million FMS funding. Within 45 days, KERO was essentially out of funds and in need of additional authority to continue operations.

Extremely cost conscious, as any nation would be in this situation, Kuwait requested an accounting of all funds on a monthly basis. Later, they asked for a complete financial summary prior to granting any request for additional funds. To meet those requests, an efficient method of managing and displaying project information and funding status had to be developed quickly. Similarly, more than 1,000 damage survey reports had served to inventory, record and quantify the damage, but a system of managing this information was needed.

Using standard software packages and lap-top computers operating on generator power, KERO engineers developed and implemented a computerized project data base within a few days of their arrival in Kuwait. A substantial achievement, this data base allowed field engineers to add or modify project information as field work, estimates or construction was completed. This gave PMs a continuously accurate information base and the capability to manipulate the data as required to prepare budget documents and reports rapidly.

Project data was sorted by the Kuwaiti ministry sector and presented to the appropriate ministry representatives for decisions on priority, timing, and scope. KERO PMs soon found that their counterparts, doing their best despite a lack of time, staffing, information, and facilities, were unable to respond quickly to such requests.

Working feverishly against time, KERO PMs and resident engineers collaborated to organize a prioritized line item repair program for each ministry, based on their acquired understanding of the ministry's function and the known damage. The PMs then presented these programs to the respective ministry authorities for approval. Once approved, individual programs were organized into a nationwide KERO repair program and briefed to DRAO and the KERP central committee for funding. This entire process was accomplished in little more than one week for the augmented $212 million KERO budget for 1991-1992.

Later, the KERP committee reserved the authority to adjust funding among programs, but allowed KERO some flexibility to move funds within a program, provided the committee was notified. This process was summarized and reviewed in biweekly meetings with the KERP committee which also served to monitor progress, and add or delete projects.

To stay abreast of fast-moving project operations and funding transactions, it was necessary for KERO and DRAO to hold weekly in-process reviews (IPRs), similar to Corps monthly project review boards. Again, the data which formed the basis for these reviews emanated from the project data base. This was manipulated to form project management summaries, bar chart program schedules, key project fact sheets and other management documents. This same automated system of reports was used to inform higher headquarters, DOD, the ambassador, Kuwaiti ministers, and other interested parties on the status of projects and KERO operations.

Overall, several salient features of the budgeting operation should be noted for future operations. First, a computerized and flexible project management data base was needed from the very start of operations. This system enabled KERO managers to convincingly demonstrate their control of projects and costs. Secondly, KERO task force engineers were frequently close to the action and well versed in project details. Consequently, they were the best qualified personnel to develop and defend budget requests.

Finally, frequent communications with host nation decision makers were established to obtain program decisions, ensure acceptability of plans and operations, provide information, develop good working relations and establish credibility. A nation assistance task force cannot operate in a vacuum—even though they, and the host nation government, may be constrained by time as a result of the crisis.

Contracting

Speed and, later, control were the driving forces in all KERO contracting operations from the outset. KERO staffers planned for a 45-day competitive emergency contract award cycle to be executed from Saudi Arabia. They were eventually forced to use a 10-day contingency plan when the war ended more quickly than expected.

Working nearly around the clock and without specific knowledge of the conditions in Kuwait, the KERO staff, with their Kuwaiti counterparts, completed necessary project scoping, solicitation, prequalification, and proposal evaluation actions. They awarded eight letter contracts worth approximately $25 million within this extremely compressed time period. These letter contracts were further defined after mobilization, once the actual scope of the repair mission was known.

To divide the work among the contractors, Kuwaiti projects were organized into either functional or geographic work sectors according to prewar work management conventions. Consequently, the eight contracts were divided among the following areas: general building repair (in three areas of the city); road repairs; sewer/water pipe repairs; port surveys; electrical repairs, and specialized building repairs. Because this scoping followed pre-war conventions, the Kuwaiti government management structure was perfectly aligned to participate in decisions and to later take control of operations.

Because these letter contracts were essentially cost-plus instruments, a precise method of controlling and documenting the flow of work to the contractor was required once construction operations began. For control and contract administration, the original DAGs were converted to standard Corps' resident offices once mobilization was complete and construction began in earnest.

For the purpose of passing specific work requirements to the contractors, the DSRs prepared during the survey phase were

Construction crews repair Nuiseeb Road near the Saudi border. (Photo by Jonas Jordan)

converted into work orders. These documents resided in the project data base. They were reviewed and modified to define the exact scope and estimated cost of work orders, and serve as the plans and specs during construction. They ultimately provided the basis for final negotiations on price and time.

As the operation progressed, larger projects were individually advertised to enhance competition and encourage participation of both American and Kuwaiti small businesses. However, this conversion to individual competitive contracting was extremely difficult with the limited KERO staff. By this time, more than $100 million in cost-plus contracts, with well over 150 active modifications, were in progress. In addition, the time required to formulate, advertise, and award a competitive, fixed-price contract to an uncertain group of bidders was both risky and prohibitively time consuming for most applications.

The system of dividing the country into work sectors served reasonably well during the early stages of the Kuwait recovery and kept the contractors geographically separated. However, in future operations this geographical orientation should be discarded after a brief period of construction. Additionally, more general contractors should be employed during the middle to later stages of the recovery to enhance competition. That is, if the projected work flow and funding can justify the cost of additional contractor mobilization. If this is possible, proposals for individual work orders could be offered to competing contractors for greater cost efficiency.

As a rule of thumb, each general contractor must see a potential workload of $50 to $100 million to justify mobilization. In the case of Kuwait, the contracting operation was initially sized for a $50-$100 million horizon, based on the best information available at the time and guidance from Kuwait. The eventual $300-$400 million workload could not have been forecasted accurately enough to justify the risk of additional mobilization. In fact, as many as ten contracts were considered at one point, but the option was discarded because the cost of mobilization would have consumed an inordinate percentage of funds available for construction.

Another contracting method worthy of consideration is job order contracting. This method awards an indefinite delivery, general construction contract based on competitively bid, fixed-unit prices. Actual quantities are specified in the field via delivery orders generated from damage survey reports or similar documents. The unit prices are fixed upon award, except for out-of-scope work, which is negotiated as a modification.

In this case, the restrictions are

two-fold. First, the considerable up-front work involved in preparing the unit price contract specification for solicitation, award, and administration is time prohibitive unless this data is already available and computerized from prior work experience in the region.

Second, as with other fixed-price contracting, the method presumes at least general knowledge of the scope, cost and availability of materials, labor and other factors which mitigate the risk of a fixed-price bid. In the case of Kuwait, even if the voluminous specifications could have been prepared and distributed in time, it is doubtful that contractors would have accepted the considerable risk of a fixed-price contract since virtually all pricing factors were unknown.

In retrospect, it appears that some form of cost-plus contracting is inevitable in an operation such as this. The instrument must be flexible enough to shape the scope of the work as it becomes known, responsive enough to meet the urgency requirements of the crisis, and yet controllable enough to ensure cost efficiency. Staffing plans must consider these factors and allow sufficient government staffing for adequate contract supervision, administration, and—most certainly—audit.

The role of auditors very early in the contract operations scenario cannot be overemphasized for cost-type contracting. While engineers are supervising contract execution, the auditors can shape the allowable range of contract overhead and specify the level of cost and pricing data required to support the contractor's costs. The sooner these parameters are established, the sooner an efficient flow of modifications, negotiations and eventual contract close outs can be established.

Logistics

Engineers are not logisticians, and even great and dedicated engineers cannot do a day's work, let alone several months of intensive work in a hostile environment, if they cannot eat and sleep properly. For example, the valuable data base previously mentioned required computers, generators, copiers, paper, cartridges, and spare parts on a daily basis. In short, the success of an operation of this magnitude and duration revolves around the efficiency and effectiveness of its logistical operation.

The KERO planning team, working with Transatlantic Division, had to assume that nothing would be available for use in Kuwait, except perhaps a building shell to serve as a shelter. Since KERO was an ad hoc TDA organization which did not exist prior to this operation, it had no organic equipment and no property book. Further, since all costs were to be borne by the Kuwaiti government, new equipment would have to be purchased on short notice with Kuwaiti funds and subsequently turned over to Kuwait when the mission was completed.

Everything needed to sustain KERO operations for 30 days, from vehicles to copiers, and personal hygiene products to food and water, had to be purchased in Saudi Arabia in the same 10-day period mentioned earlier, and loaded on semi-trailers for the journey to Kuwait. It's hard to describe the expression on a local automobile dealer's face when a KERO purchasing agent walked into his showroom on 18 January and purchased 62 4x4 vehicles for immediate delivery. Overall, virtually nothing was forgotten in over 4,000 line items needed to support operations.

As a result, the KERO team was able to conduct self-sustained operations almost immediately on arrival. However, even the best planned operation is not perfect. A rapid resupply base must be available to replenish critical items which cannot be found locally, or to satisfy new requirements which develop as the operation matures and changes. This function was accomplished by Transatlantic Division in Virginia, using commercial air cargo resources via a sister office in Dhahran, Saudi Arabia.

Two aspects of this logistics tale deserve special consideration in future nation assistance operations. First and foremost, the equipment used by the team is host nation property and must be treated as such. Accountability, maintenance and repair, and the general condition of host government property are all key components of the image of quality performance which the task force seeks to leave behind. The reputation of the Corps and the U.S. Army is at stake.

Similarly, the crisis situation notwithstanding, the host government does not want a rag-tag outfit operating in its country, exposed to its own population and the world media. Both of these factors are political indicators of the strength of the host government and its recovery operation, and deserve careful monitoring. Translated into day-to-day operations, this means strict care of equipment and rapid attention to repairs, housekeeping, uniforms and the like.

Another logistical consideration which deserves careful attention is "the cost of doing business." Again, notwithstanding the crisis environment, the recovery operations must be sufficient for quality operations but not extravagant.

In KERO operations, the target was to hold pure overhead costs to less than 10 percent of all expenditures. KERO engineering salaries were charged to projects as direct costs wherever possible. Consequently, actual overhead costs came in around 8 percent, which was eminently satisfactory to the Kuwaiti government. This figure does not consider the salvage value of approximately $2 million worth of vehicles and equipment. They will ultimately be returned to the Kuwaitis to produce a final overhead figure of around 7 percent.

Politics and Partnering

There is no question that operations like this have political overtones at all levels which must be carefully managed. Engineers are dealing with vast cultural differences which, in spite of the unbridled goodwill exhibited by all participants, could easily result in disagreements and lasting misperceptions. After all, aside from the humanitarian relief afforded by the nation assistance effort, the only lasting benefit for American national interests is the goodwill and lasting working relationships generated by the engineering management process. These are political rather than construction products.

The first and foremost consideration for a lasting professional image was the quality of construction provided. Early on, during the heat of the crisis phase, there was tremendous political pressure to conduct only emergency repairs to facilities so that limited funds could be spread over many project areas. Experience has shown that for all but the smallest repairs to facilities, this tolerant "crisis" attitude will subside long before the completion date of the work.

Consequently, in the calm, post-crisis environment, the user may not recognize this emergency scoping as quality construction, and he will complain bitterly that he has been served with shoddy work. Such problems need to be resolved immediately, on the ground, with the customer—preferably in his favor—rather than through administrative appeals. This is especially true for major programs which affect large groups of citizens, as these projects justifiably receive close scrutiny and media coverage. Here, a strong, involved, and active public affairs officer can ensure balanced coverage so that such problems do not receive undue attention.

A corollary of this concerns project selectivity. All projects do not have equal value in light of U.S. political and national security objectives and values. The same is true for the host nation population. Progress will undoubtedly be reported by the American media, and consequently every project in the Corps program must appear as beneficial to Americans as to the host country. The validity of the support provided must always appear justifiable and humanitarian to the supported population, and to the American taxpayer. These media observers, who shape political decisions through public opinion, often will not give sufficient consideration to the intricacies of the project approval process.

In general, projects acceptable for U.S. government construction will suffice for the host nation population. In other words, projects which support major population segments, versus those which satisfy the goals of special groups, are usually acceptable.

On the other hand, planners should not be complacent and say "it's their money, they can do what they want with it." Some citizens of host countries may easily accept the use of government labor to work on private projects as one of the perks of high office. It may even be sanctioned legally, but such practice would never be condoned or understood in the U.S., and should be avoided. For example, work on private residences, ornate buildings, and VIP facilities should be avoided unless there is an overriding and unmistakable social value. In Kuwait, reconstruction of the national parliament involved very special and expensive construction and furnishings. But the overriding value of providing a necessary and suitable facility for the return of democratic government in Kuwait was universally acceptable in both the U.S. and Kuwait.

As a general rule, U.S. forces should always be used for the "highest and best" purposes which afford the maximum positive image and the least risk, political or otherwise, to our government and our personnel. Projects which do not fill this criteria should be recommended for construction by private contractors working directly for the host government. Close cooperation with the U.S. ambassador and his staff will serve to provide the political sensitivity necessary to properly screen projects.

A second consideration for construction managers is the political problem of "who's in charge" of the nation assistance effort. Clearly, the host nation must be in charge, and U.S. elements must keep this steadfastly in mind. This is not as trivial as it appears because engineering judgments, which we make routinely and frequently without asking, are often driven by our own cultural imperatives—which may not be valid in the host nation.

For example, Americans, as a general rule, value time more than money—especially in crisis situations. Eastern cultures are much more patient. Cost and perceived value are more important than time, and this difference can cause major disagreements and the misperception that Americans are not good managers.

A corollary to this example is the role of true partnership with host nation managers. In the case of Kuwait, the host nation managers were adamant about having a partnership with the Americans. This desire stemmed from their need to direct their own destiny in a professional way, and from their sincere desire to learn the American way of managing a project.

True partnership was relatively easy to achieve in field engineering activities through the use of Kuwaiti volunteer engineers who were assigned to KERO. These engineers worked side by side with their American counterparts throughout the entire recovery operation and shared every experience. Consequently, the Kuwaitis and Americans developed a mutual understanding of each other, and from that came the respect and trust which formed a true partnership.

That is not to say that problems didn't exist. There were many differences in work practices, compensation, privileges, and housing arrangements—all of which were potential areas for discord. These were discussed as each case arose and a conscious effort was made to ensure that both Kuwaitis and Americans followed the same rules and practices.

At the managerial level, the partnership was equally important but harder to achieve because of the complexity of managers' responsibilities, and the time constraints on their respective schedules. The individuals involved had to make a concerted effort to include their counterpart in any and all decisions pertaining to the recovery program.

This usually caused a time delay and additional discussions. But the time was well spent because it prevented later misunderstandings and delays during construction. In fact, in almost every case where consensus on policy was not achieved prior to a construction decision, there were misunderstandings and delays during the critical—and more costly—construction cycle.

Finally, the task force commander can also expect considerable attention from DA, DOD and the U.S. Congress. These agencies all require current and accurate information on all operations to fulfill their responsibilities and answer constituent questions. Consequently, a comprehensive, rapid, and preferably automated reporting system must be developed early on.

In Kuwait, both Transatlantic Division and the Defense Reconstruction Assistance Office (DRAO), utilizing reports from KERO, interacted directly with these agencies to provide accurate information, answer inquiries and relay sensitivities to KERO. This allowed KERO to concentrate on engineering and construction activities rather than external coordination.

Conclusion

To sum up the Kuwait experience in a few words is difficult. There were so many lessons learned that this article can only scratch the surface. Some general thoughts are important, however.

First of all, as an intergovernmental operation, the Kuwait experience was a tremendous success. The humanitarian spirit of the participants easily bridged cultural and professional differences and paved the way for close cooperation and good working relations. What resulted from this cooperation was the prospect of a long-term relationship—based on trust and goodwill—that is probably more important than the operation itself. Of paramount importance to these excellent working relations was the responsive and accountable support of the engineering management structure in KERO. Budget documents and funds accountability were precise and convincingly accurate. This is of cardinal importance to the establishment of trust with the host nation.

Second, a true and honest partnership in all engineering decisions eliminated potential misunderstandings which could easily have delayed construction and undermined the completion of key projects.

Finally, free and open communications with all parties ensured that both U.S. and Kuwaiti government officials—and their constituents—understood exactly what was happening as the recovery progressed.

The Kuwait recovery was a satisfying and professionally exciting experience for all who had the opportunity to participate. As an intergovernmental experience, it holds promise for future application, not only in the aftermath of a conflict, but potentially as a conflict management or conflict reduction mechanism which warrants serious consideration.

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Nation Assistance:

An Evolving (But Not New) Concept

By Major Boyd D. Houck

"The mission of the 146th Engineer Detachment can be broken down into four discernible areas. [The unit must] maintain the capability to deploy Mobile Training Teams to provide military instruction in engineer-related fields... be prepared to deploy Technical Assistance Teams capable of providing assistance to the military and para-military forces of Latin America... be equipped to provide Civic Action Teams to assist the civilian population in nation building activities... [and] provide physical support setting up Special Forces Operational bases and furnish guidance to the 8th Special Forces Group command and staff."[1]

Does this sound like the current mission for a unit heading for Latin America in a few weeks? It is, in fact, extracted from an article on the 146th Engineer Detachment in the Summer 1971 issue of *ENGINEER* magazine. While the Army's involvement in nation assistance (a term which evolved from nation building) is currently receiving a lot of attention, the concept is certainly not a new one. This article addresses the evolving concept of nation assistance.

Nation assistance is not an engineer-specific term or even a purely military one. The concept applies to certain types of activities conducted by any United States government agency. Within the military, engineers are often mentioned in conjunction with nation assistance because of their unique capability to support it. Every arm and branch of the military, however, continues to make significant contributions to nation assistance.

In general terms, nation assistance is cooperative action between the United States and another nation to promote internal development and the growth of institutions within that nation. The U.S. government conducts nation assistance

Engineers lower a submersible pump into a well casing on Tiger Island, Honduras .

activities to promote stability within a specific country or region of the world. There are several key points related to this description of nation assistance.

First, nation assistance is a *cooperative* effort between the U.S. and another nation. Next, "institutions" in the context of nation assistance is a very broad term. It ranges from national agencies such as the host nation's military, its ministry of public works, and so forth, to local organizations such as public education and health services. Finally, the host nation (in conjunction with the United States) must establish objectives for internal development that meet the needs of their people. These objectives may include the reduction of poverty, the equitable distribution of the benefits of national development, or taking steps to ensure continued prosperity within the nation. The achievement of these objectives contributes to stability both within the country and within the region.

Though a lot is said and written about nation assistance, exactly what it consists of is still a subject of debate. The definition continues to evolve. The coordinating draft of Army Field Manual (FM) 5-114, *Engineer Operations Short of War*, contains the following proposed definition:

> *"Nation assistance is political, economic, informational, and military cooperation between the United States and the government of another nation, with the objective of promoting internal development and the growth of sustainable institutions within that nation. This corrects conditions which cause human suffering, and improves the quality of life of the nation's people. Nation assistance is conducted to promote stability within the world, which is in the U.S. national interest, as well as for humanitarian reasons."*[2]

Training and Doctrine Command (TRADOC) published TRADOC Pamphlet 525-5, which is the umbrella concept for AirLand Operations, on August 1, 1991. It contains the following definition of nation assistance:

> *"The primary supporting concept of peacetime engagement that seeks to coordinate the use of all U.S. political, economic, informational, and military assistance for a host nation's program to promote stability, sustainable development, and institutional growth responsive to the people's needs. DOD, working in concert with other U.S. agencies and at the host nation's request, provides health, technical, management, and other assistance consistent with authorizing legislation to achieve the desired goals. Nation assistance emphasis is on developing host nation capabilities in key areas by transferring skills to civilian and military sectors. These actions are integrated through the U.S. government's country plan."*[3]

Both definitions include the concept that nation assistance is a cooperative effort. This cooperation must exist not only between the U.S. and a host nation, but also between U.S. agencies operating

National Guard engineers work on a block wall during construction of a school in Comayagua, Honduras .

within a country. Both emphasize the importance of nation assistance in responding to the needs of the host nation's people. They also address sustainable institutional and internal development, which result in increased stability.

The primary objective of nation assistance is to promote stability in a country or region. Stability in this context is orderly change, not stagnation. In many developing nations, the government faces a major challenge in ensuring balanced development. If modernization and development do not improve the standard of living of all the nation's people, discontent may develop.

Perceived inequity in the distribution of the benefits of national development may create an environment in which an insurgency may take root. While one should not view nation assistance purely as a counterinsurgency strategy, failure to develop the type of national environment a nation assistance program seeks to promote may create favorable conditions for insurgent activities.

The concept of nation building, from which the concept of nation assistance evolved, refers to efforts to integrate the people of a developing nation. As one political science reference described it, "Nation building is an architectural metaphor for the process induced within a state to integrate the country and tie the inhabitants together in a national fellowship."[4]

In the 1960s and 1970s, the term "nation building" was in common use, although the general concept had been in existence for many years.[5] The U.S. military participated in various roles in support of nation building, including building our own nation. In the late 1980s, a perception developed that the term "nation building" had negative connotations when addressing America's role in the development of emerging nations. It implied that the U.S. was building other nations in our own image, rather than allowing these countries self-determination in their development.

Around the turn of the decade, "nation assistance" began gaining favor as a less pejorative term.[6] However, it is not uncommon to still hear "nation building" and "nation assistance" used interchangeably, even though there is a philosophical difference between the two terms.

The lack of a clear-cut description of what activities fall into the category of "nation assistance" is an indication that the concept is still evolving. Some of the activities which nation assistance may encompass include some types of security assistance, disaster relief, humanitarian and civic assistance, combined exercises, and deployments

As part of another school project in Honduras, a soldier puts finishing touches on a door before installing it.

for training. The actual process for selecting, developing, and funding specific projects or programs is beyond the scope of this article. However, I will address some basic principles that apply to nation assistance.

Image and Perception

Nation assistance activities should strengthen the image of the national and local governments in the eyes of the populace. This increases national unity and promotes stability. Nation assistance programs must be designed so that the perception of the host nation's people (as well as the actuality) is that their government is the guiding force. A perception that the U.S. is imposing its will in a region, rather than cooperating with the nation's government, may create problems. Such a perception may weaken the local government and create (or aggravate) conditions which cause instability.

Coordination

Nation assistance activities must be coordinated efforts between the host nation and all U.S. agencies involved (Department of State, Drug Enforcement Administration, and so on). This coordination is essential to achieve the maximum overall effect rather than isolated accomplishments. Lack of a master plan may result in situations such as bridges with no roads between them, roads without bridges, or health facilities with no clean water supplies.

To facilitate coordination, the U.S. ambassador's country team (working with the host nation) will develop a "country plan." A key member of this team is the United States Agency for International Development (USAID), an agency of the Department of State. Cooperation between military planners and USAID within a country will assist in developing a coordinated master plan for developmental assistance. The country plan contains a "vision" of what the U.S. and the host nation should do together. The host nation must fully concur with this vision, as well as the method of achieving it, for nation assistance to be successful. In other words, the host nation must "buy in" to the program or it will become a unilateral effort rather than cooperative one.

Expectations

Expectation management is a key aspect of nation assistance. National development results in rising expectations on the part of the populace. As the people of a nation see the benefits of development accrue to others, they will want more for themselves. While this is understandable, it may not be possible for a government to meet the people's desires on a schedule that satisfies them. Expectation management is essential in all host nations with which the U.S. deals. The government and the people of the host nation must not be given any promises that the U.S. may not be able to fulfill. To do so may cause unwarranted resentment toward the U.S.

Self-Help

The objectives of a nation assistance program must meet the needs of the people it is designed to help. A key point here is that a program should attempt to develop a host nation's capabilities, rather than simply provide a temporary solution to a problem (which may then require repeated involvement by the U.S.).

For example, planners should plan and execute a bridge construction project in such a way that a host nation learns to build their own bridges, and not simply be the recipient of a bridge built by Americans. Also, the project design must take into account the skill and technology level of the recipients.

The results of the program must be maintainable (structures or facilities) or sustainable (technologies or capabilities) by the host nation. Projects that make extensive use of local contractor support benefit the host nation in two ways. First, the material or service provided by the contractor contributes to the finished construction project, which is an asset to the local populace. Second, the ability of the host nation to conduct its own development is increased as contractors gain experience.

Need

Planners must carefully research projects which the U.S. will support as part of a nation assistance program. Projects should meet a genuine need. They should benefit the majority of the population in an area, not just a few individuals. The projects should not offend cultural or religious norms. They should make maximum use of local resources (subject to U.S. statutory limitations).

Whenever possible, projects should be achievable in a short time frame. They should provide maximum visibility and credit for the local government and have a measurable impact. A completed project has greater impact if the local populace feels that it contributed to identifying the need for the project, and participated in completing it.[7]

A Joint Venture

Joint action by U.S. and host nation military and civilian personnel is a key part of reinforcing the concepts of U.S./host nation cooperation and transferal of capabilities from America to the host nation. Civic action projects in particular should be a joint venture. When U.S. forces and host nation personnel work together on a project, several benefits are gained. First, the local populace gains ownership of the finished product. The host nation military and civilians gain valuable skills (management, construction, and so forth). The people of the host nation see their government helping their society. Perceptions regarding the U.S. are improved. And American soldiers gain a better understanding of the host nation.

Training Opportunities

Nation assistance activities in which U.S. military forces are involved will generally provide a training opportunity. This serves the dual purpose of improving U.S. relations abroad while maintaining a trained and ready force. The concept is not new, as this 1951 example indicates:

> *"Assistance by Army Engineer units in a project such as this [the construction of a sports field] serves as a means of training for engineer equipment operation and materially enhances understanding between the United States Army and [local] communities. Some of the conditions under which this assistance is provided to communities are: that the equipment is readily available; that it not be required for military projects; that the project be practicable; and that the community be willing to assist with hand labor and make the finished sports or play area available to all youth who desire to use it."*[8]

When a U.S. military unit is involved in a nation assistance project during an exercise, the exercise objectives must be clearly defined. This will prevent confusion on the part of the U.S. participants and disappointment on the part of the host nation. While all nation assistance projects should offer some training value to the U.S. forces involved, some projects will be more focused on training, and some on assisting the host nation.

Local Governments

It is essential that U.S. personnel executing nation assistance activities coordinate closely with the local government in their area of operations. This coordination will improve civil-military relations and reduce the chance of misunderstanding between U.S. forces and the local populace. The local government is best suited to address the needs and desires of the people. Americans must remember that they are guests in the host nation. They are there at the invitation of that country's government to provide cooperative assistance.

Doctrine

Although the U.S. Army has conducted nation assistance type activities for many years, there is currently no doctrine which specifically addresses it. FM 100-5, *Operations*, makes no mention of nation assistance. The Combined Arms Command (CAC, a doctrinal integrating center within TRADOC) is currently revising this manual. The new version will include nation assistance as part of Army doctrine. To facilitate this revision, CAC has published several versions of a nation assistance "enabling concept" to collect input from within the Army.

FM 100-20, *Military Operations in Low Intensity Conflict,* contains the Army's doctrine for operations in low intensity conflict environments. While not specifically addressing nation assistance, it does contain many of the concepts that apply to nation assistance activities. Looking at engineer doctrine in particular, FM 5-100, *Engineer Combat Operations*, does not mention nation assistance by name. It addresses it in concept, citing "spreading government influence and encouraging national unity in developing countries."[9] FM 5-114, *Engineer Operations Short of War,* provides engineer doctrine for operations short of war. It addresses nation assistance in some detail, and contains many of the basic principles included in this article. This manual is currently in coordinating draft.

Nation assistance will continue to be an important mission for the Army as we move toward the end of this century. While the Army must prepare for its primary mission of fighting and winning a land war, it is in our interest to support activities which lessen the chance for armed conflict. Working cooperatively with other U.S. government agencies and host nations worldwide, Army engineers can continue to build a more stable world.

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Endnotes

[1] Captain Dennis F. Pierman, "From South of the Border," *The Engineer*, vol. 1, no. 2 (Summer 1971): pp. 6-9.

[2] U.S. Army Engineer Center, Field Manual 5-114 (Coordinating Draft), *Engineer Operations Short of War* (Fort Leonard Wood, MO: U.S. Army Engineer Center, May 1991), p. 1-28.

[3] U.S. Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-5, *AirLand Operations: A Concept for the Evolution of AirLand Battle for the Strategic Army of the 1990s and Beyond* (Fort Monroe, VA: TRADOC, 1 August 1991), p. 48.

[4] Vernon Bagdanor ed., *The Blackwell Encyclopedia of Political Institutions* (New York, NY: Basil Blackwell, Inc., 1987), p. 379.

[5] Books written in the 1960s and 1970s on nation building. These include:

R. Bendix, *Nation-Building and Citizenship* (Berkeley, CA: University of California Press, 1977).

K.W. Deutsch and W.J. Foltz eds., *Nation Building* (New York, NY: Atherton, 1963).

S.N. Eisenstadt and S. Rokkan eds., *Building States and Nations*, 2 volumes (Beverly Hills, CA: Sage, 1974).

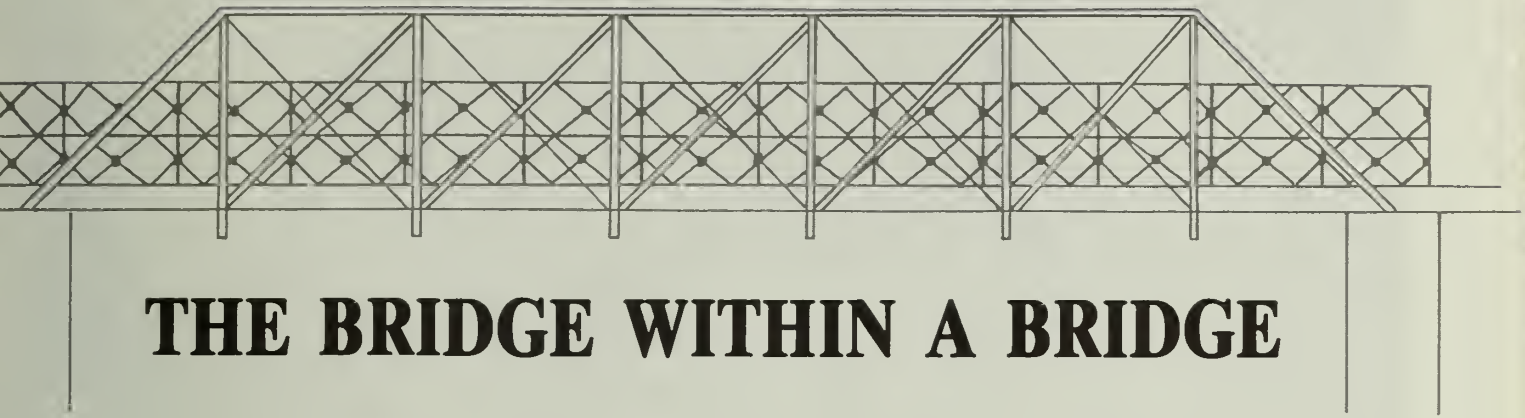
The basic concept of nation building has been in existence much longer. It "became prominent after the dissolution of European colonialism." (*The Blackwell Encyclopaedia of Political Institutions*, p. 379)

[6] One example comes from the following source: Lieutenant General Henry J. Hatch, Chief of Engineers, "Security, Stability, Sustainability: Conditions for Peace," p. 6. This paper was presented at the National Defense University conference "Evolving US Strategy for Latin America and the Caribbean: Mutual Hemispheric Concerns and Opportunities for the 1990s," 15-16 November 1990.

[7] Several of these principles were drawn from the following source: Department of the Army, Field Manual 5-100, *Engineer Combat Operations* (Washington, DC: U.S. Government Printing Office, 22 November 1988), p. 91.

[8] E.P. Hanifan, "The Army Lends a Helping Hand," *The Military Engineer*, vol. XLIII, no. 294 (July-August 1951): p. 279.

[9] Field Manual 5-100, *p. 91.*



THE BRIDGE WITHIN A BRIDGE

By Lieutenant Colonel John L. Craig, Major Theron L. Smith and Master Sergeant Richard W. Bates

On the night of November 12, 1990, a sand-laden snowplow attempted to cross a 93-year-old single lane bridge in Port Byron, New York. The snowplow's blade struck a vertical member of the bridge structure, and a 40-foot section of the bridge's roadway collapsed into the Seneca River. The plow and its two crewmen were sent careening 16 feet into the icy water. They were badly shaken, but not seriously hurt.

The bridge, however, was another story. The 133-foot bridge, which served as the only access to Haiti Island (see map inset), was now useless. Several dozen families were left stranded on the island, and were cut off from heating oil, groceries, mail, and emergency services.

As a temporary measure, a small flotilla of boats, rafts and canoes served as a stop-gap delivery and crossing service. Three days after the accident, Cayuga County engineers built a temporary foot path across the damaged bridge. But the path was only capable of supporting one person at a time. With the winter weather getting harsher every day, the residents of Haiti Island needed vehicular access to their homes—and soon.

Echo Company

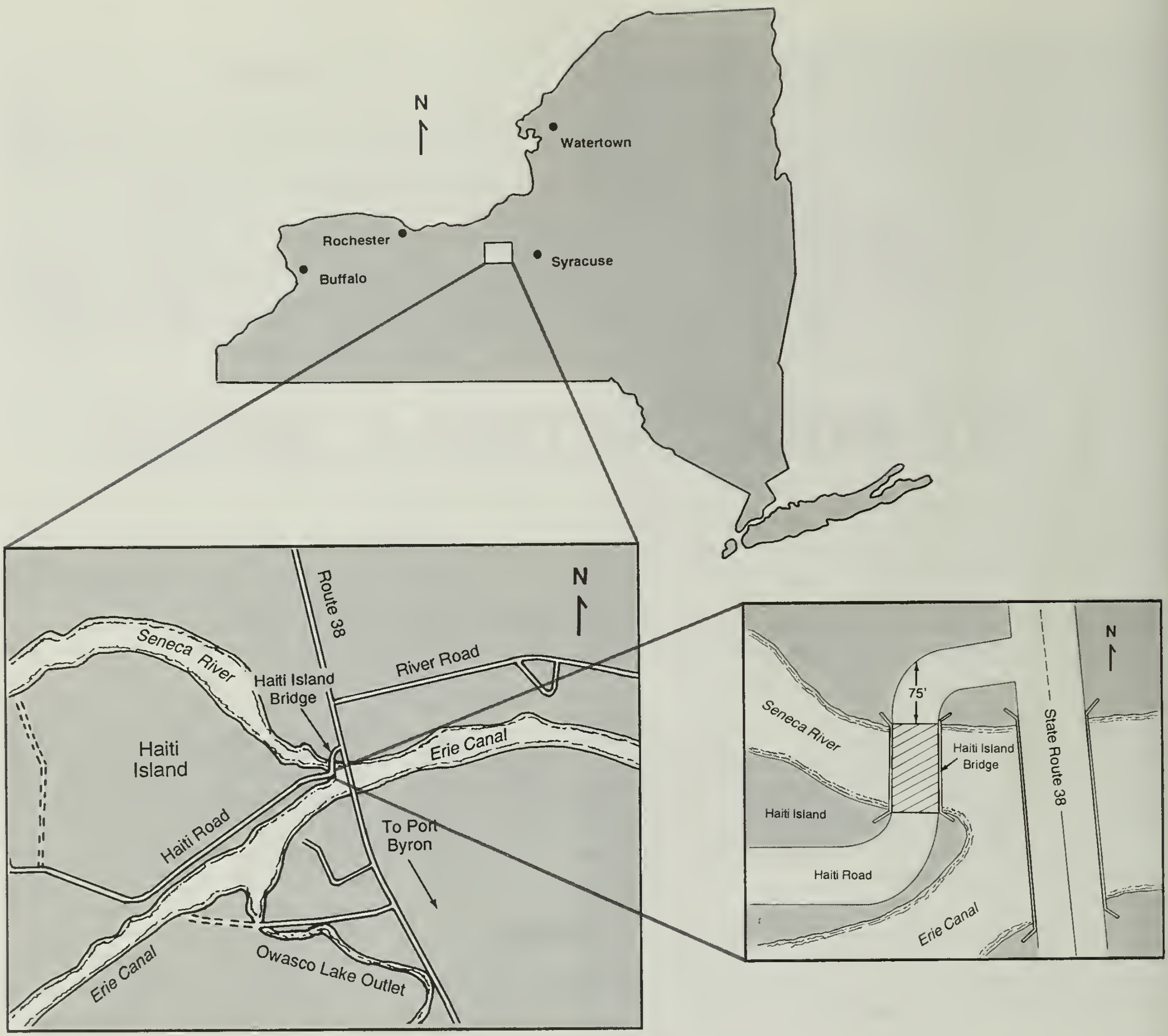
The day after the accident, an evening television newscast about the bridge caught the attention of Reserve infantry Major Tad Smith, the commander of E Company, 2nd Battalion, 391st Regiment, 98th Division (Training). Thinking that his unit might be able to help the residents of Haiti Island, Smith contacted John Ozolins, the county's highway superintendent. Ozolins, who happened to be an Army National Guard engineer officer, listened to Smith's rundown of Echo Company's bridging capabilities—which included Bailey bridge construction.

Enthusiastic about Echo company's potential assistance in getting the bridge fixed, Ozolins told Smith that the New York State Department of Emergency Management, along with the state's Department of Transportation (DOT), owned several sets of M1 Bailey bridge parts. These parts, all World War Two surplus, were scattered throughout the state in several storage locations. If officials were to declare a state of emergency, those parts could be made available for the construction of a temporary bridge to Haiti Island.

Ozolins and Smith agreed to pursue the joint project, and started contacting appropriate officials and key personnel in both government and Army channels.

On the Army side, an initial coordination meeting was held. Sergeant First Class Don Hoffman, Echo Company's most experienced Bailey bridge NCO, and Master Sergeant Richard Bates, a bridge specialist assigned to Readiness Group Seneca, served as the resident Bailey bridge "gurus" for the project.

One week after the collapse, Hoffman and Bates, along with Echo Company engineers, visited the site. Hundreds of



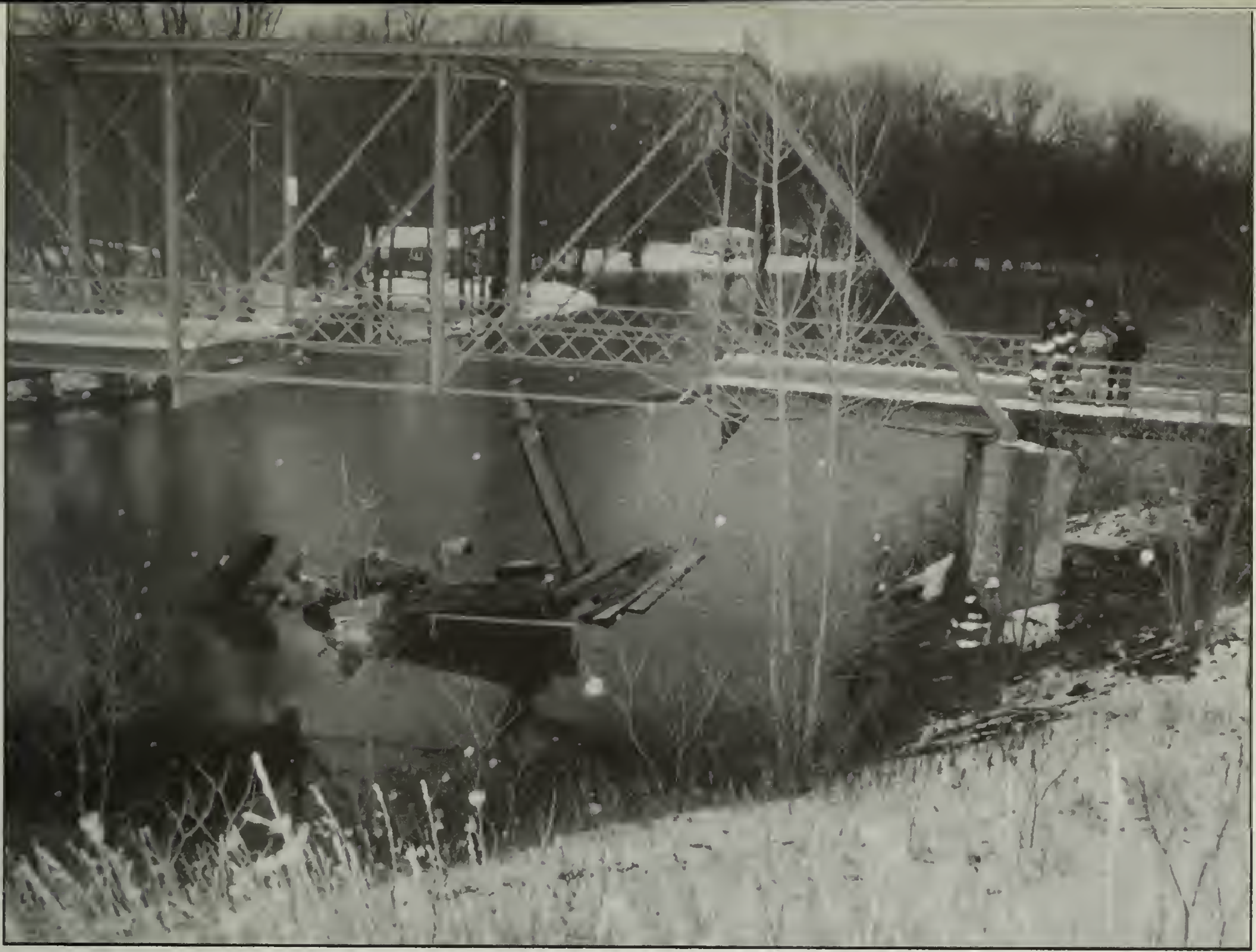
Maps courtesy Cayuga County Planning Board

measurements were taken, along with an hour's worth of video tape of the bridge.

Echo Company personnel then proceeded with a design proposal for the bridge. It was decided that a Class 30 bridge would be needed. The company decided to build an initial 140-foot double-single bridge (Class 8), with a later upgrade to a Class 30 double-double. (On completion of the upgrade, the New York DOT, perhaps because of the unusual nature of the project, conservatively rated the bridge as a Class 15).

Ozolins made initial contact with other highway personnel, along with local and state officials, and scheduled an initial joint planning meeting. He also reviewed several considerations that would impact heavily on any bridge reconstruction efforts:

- The only accessible site for a replacement would be within the superstructure of the existing through-truss bridge. Its massive steel trusses and overhead bracing system remained in place, even with a 40-foot section of substructure missing.
- No one from the New York State DOT had ever built a Bailey bridge and launched it in a counterbalanced configuration. The standard DOT method was to assemble the bridge on the ground, and use large cranes to lift it into place. This was not possible at Haiti Island without first removing the existing bridge.
- While some of the Bailey parts were stored inside and were well maintained, most of them sat in open storage yards. These parts did not appear on any central inventory, and their condition was questionable. To compound these difficulties, the only DOT personnel who knew what Bailey bridge parts looked like had retired long ago.



Haiti Island Bridge the morning of November 13, 1990, the day after its failure. Forty feet of roadway collapsed into the Seneca River when a snowplow struck one of the bridge's vertical beams. Note the partially submerged plow. (Photo by Craig Jackson, by permission of Syracuse Newspapers)

- The temporary foot bridge would be of little use in reconstruction efforts. It was only rated for crossing one person at a time, and no construction loads would be allowed. A close examination (including X-rays) of key support points on the old bridge indicated that some of the critical support bolts were at 25 percent of their original strength. Civil engineers had already placed cabling along the trusses to reinforce these bolts.

The first planning meeting had more than 30 participants. Representatives included New York DOT, Waterways, State Emergency Management, law enforcement and fire safety officials, and aides to State Assemblyman Michael Nozzolio.

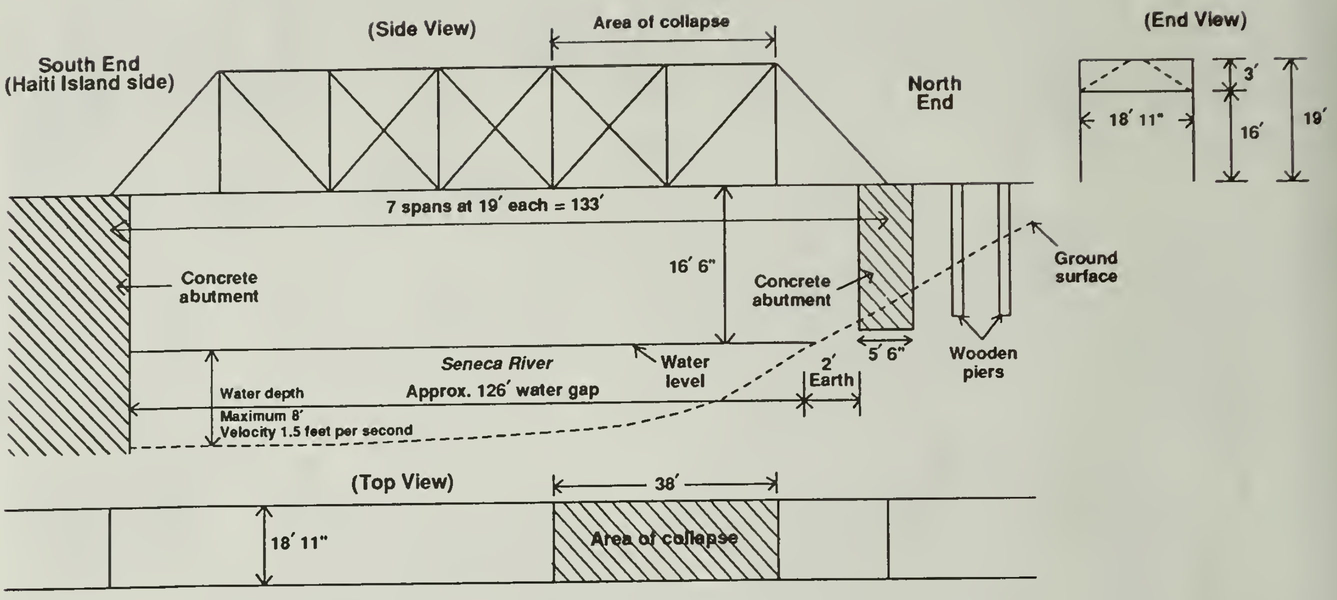
Echo Company personnel presented their proposed plan to the group, using a Bailey bridge Training Extension Course (TEC) tape to illustrate their proposal. Promises of support at the start of the meeting were followed by looks of disbelief as the briefing progressed. Because of the coming holidays and long-range weather forecasts, Echo Company personnel indicated they wanted to complete the bridge within the next two weeks.

The civil engineers and state officials had serious doubts about the Echo Company plan—they simply didn't believe that building a bridge within a bridge was possible under the current circumstances. The were particularly skeptical when the Army engineers told them they not only could do it—they could do it in one weekend.

However, state officials were willing to let the Army try. And, despite their concerns, they still offered their full support. Based on the company's briefing, the group gave their go-ahead to the project. Civilian authorities then formerly requested Echo Company's assistance through the office of the 98th Division commander, Major General Barclay Wellman.

Significant preparation was required to support the operation. Some of the initial steps included:

- Alert and mobilization of Echo Company for an unscheduled drill weekend three weeks before Christmas—and one week before its regularly scheduled drill.
- Completion of a detailed engineer work plan that included site layout, team assignments, equipment requirements, and man-hours.



Site profile of Haiti Island Bridge and gap

- Location and inventory of Bailey bridge parts in three state storage sites (Syracuse, Buffalo, and Watertown).
- Transportation of more than 170 tons of bridge parts to a staging area near the bridge site.
- Construction of an additional 25 feet of backspace area at the north end of the near shore. Originally, the backspace dropped off sharply at 75 feet from the near shore rocking rollers. The additional 25 feet of construction area was needed to allow counterbalancing of the launching nose and other construction requirements.
- Final rehearsal.

The Alert

A telephonic warning order was issued to all Echo Company personnel on November 23, just ten days before construction was to begin. A written order was prepared the next day. At the same time, critical personnel were called to duty in advance of the main body. The final alert order came five days later, when the work plan and inventories confirmed the feasibility of the mission. Unit response was 100 percent.

The Work Plan

Initially, the advance party was divided into teams, each with specific evaluation and coordination responsibilities. Team meetings were held daily in a command post established by Ozolins at the Cayuga County Highway Department.

The first team worked with civil engineers hired by the state to determine suitability of the site, along with the bearing points of the proposed Bailey bridge. This team was also responsible for site safety.

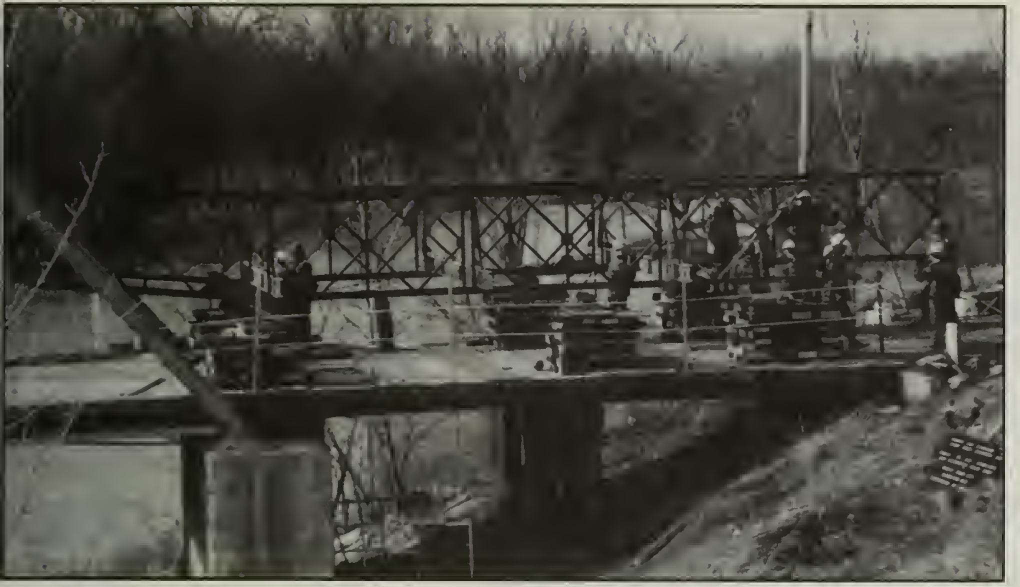
A second team was sent to the various New York DOT storage sites to examine and inventory Bailey parts. Assistance from DOT personnel was invaluable and made an almost impossible task relatively easy.

While the company executive officer and first sergeant coordinated local support, equipment, services, and food, a third team began site preparation. Working with the county highway department, the team located and cleared a staging area for the incoming bridge components. A building site less than 100 feet from a major highway was cleared and secured.

After being briefed about the 100-foot backspace requirement at the bridge, a highway department crew used fallen bridge parts and hundreds of yards of gravel to create a 100-by-26-foot secured backspace area.

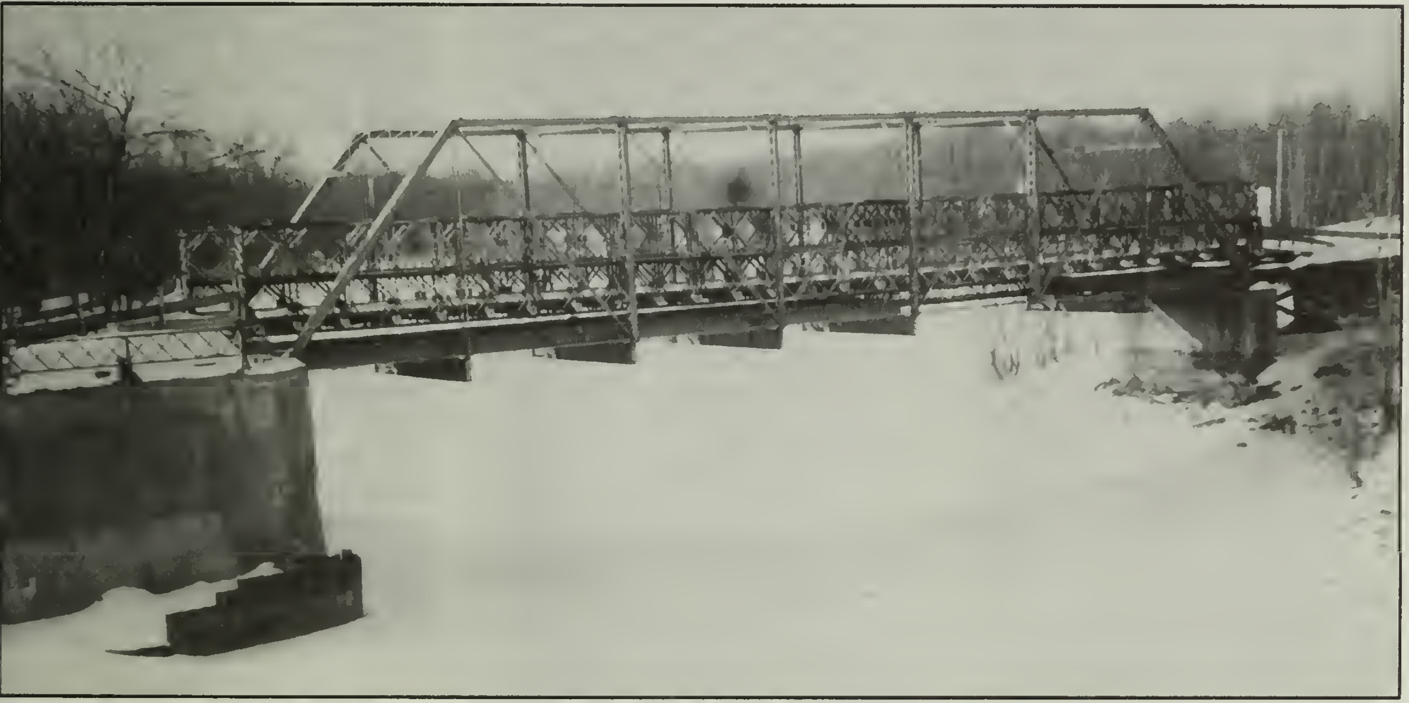
The third team also identified a 14-inch difference in height between the near and far sides of the bridge. When combined with the projected sag in the launch nose (63 inches in a 140-foot, double-single bridge with two launch-nose links), the near-shore rocking roller assemblies needed to be 54 inches above ground.

This would ensure that the planned 140-foot double-single bridge would reach the rocking rollers at the 100-foot point on the



Left: Echo Company engineers begin constructing the Bailey. Note the 54-inch cribs for the nearshore rocking rollers.

Below: The "bridge within a bridge" after completion of the project.



original bridge, and not impact (touch down) on the original decking. This, in turn, would require another team to work with the highway department to prepare cribbing for the two rocking rollers and six construction rollers.

Because of the lack of M1 Bailey bridge manuals, the decision was made to use the M2 manual (TM 5-277), with the assumption that there were no major differences between the two models other than width. The M1 roadway width is 11 feet, and the M2's roadway is 12 1/2 feet.

Inventory

After the decision was made to go with an initial double-single bridge (with future upgrade to a double-double), parts lists were compiled and given to the inventory team. The team split up and traveled with DOT personnel to the three storage sites. The resulting inventory detailed not only the number and type of parts on hand—but their condition as well. The inventory process also resulted in the team's recommendation that several Echo Company personnel be assigned to loosen and dismantle rusty parts needed for the project.

Transportation

Transportation was a three-part problem. Buses loaned to the project by the Port Byron School District did double duty. They moved troops from home station (over 80 miles away), and ferried them from work sites to the American Legion Post, where

The following six observations all had a significant impact on the mission, and should be worth noting by other engineers involved in bridging projects:

- Preparations for bridge launching did not include a complete mock-up of the existing bridge during the Bailey bridge scale model construction. As a result, when a 50-ton crane was moved by barge to the far side of the site, with the intent of letting it carry the weight of the 47.5-ton launching nose, it was unusable. Failure to fully plan for clearing the overhead bracing system of the old bridge eliminated the ability to use the crane.

- As a result of the sag in the double-single bridge, the bottom panel pins, holes, and chord bolt holes could not be brought into alignment. This caused difficulties when panels were laid on top of the double-single panels during conversion to a double-double bridge.

- To solve this problem, a special alignment tool was fabricated. This consisted of a threaded rod 18 inches long and one inch in diameter (with national fine threads), and two 6-by-6-inch, half-inch-thick steel plates with a nut on each end. The rod was put through the bracing frame bolt hole. A steel plate and nut were then attached to the ends of the rod, and the bolts tightened. This served to pull together the bottom of the sagging top panels, and bring the panel pin holes and chord bolt holes into alignment. Conversely, and as normally used, the chord jacks were used at the top of the panels to push the panels apart, and bring the panel pin holes into alignment.

- A normal roller layout worked flawlessly. The only unusual part was that at 100 feet from the nearshore, another set of rocking rollers had to be put on the old bridge decking to "catch" the launching nose. Care had to be taken so that the launching nose did not heavily impact the rocking rollers and do additional structural damage to the old bridge.

- The limited on-site backspace available for layout of equipment was adequate, but required detailed truck load plans to bring equipment from the staging area to the equipment layout site.

- A relearned lesson was that using chord jacks can be backbreaking work for such things as jacking the tops of panels apart in order to align bridge pin holes. A change in the gear ratio to improve the mechanical advantage would make the work much easier.

Finally, don't give up when someone tells you it can't be done. Frequently, as shown at Haiti Island, it can be done. Live by the motto: "Essayons!"

they ate their meals and slept.

Tools and equipment were transported on 2 1/2-ton trucks borrowed from F Company, 2nd Battalion, 391st Regiment.

Movement of the heavier bridge parts was handled by county highway department trucks and drivers. The county also provided material handling equipment for loading and unloading.

Rehearsal

The end result of all good planning is the identification and elimination of obstacles to success. Regardless of how well prepared you might feel about a mission, without an adequate rehearsal, you're only half ready.

Using dozens of photographs, hours of video tapes, and a scale bridge kit borrowed from the Training Audio-Visual Support Center at Fort Drum, team leaders conducted repeated mission rehearsals. During these rehearsals, several problems were identified and resolved. These potential problems included on-site storage of bridge parts and tools, team assignments, and load plans for the movement of parts to the staging area.

Construction

Like most successful operations, there is little to say about the actual construction of the bridge—except to say that all went as planned. It was difficult to construct a Bailey bridge on rollers that were almost five feet above the ground. It turned out that the minimum backspace area was just that—barely adequate. An additional 20 feet would have made the job much easier. While not quite like threading a needle, it's not easy to launch a 140-foot bridge through such a small opening.

The original bridge's opening was only 13 inches wider at the transoms, and only 29 inches wider at the panels, than the Bailey being launched.

Echo company began bridging operations at 8 a.m. on December 1. At 2:30 p.m. the following day, the first vehicle drove across the bridge-within-a-bridge. It had been three weeks to the day since the bridge's collapse. After the preparatory work, it took Echo Company just 15 hours to "bridge the gap."

Three months later, the company returned to Haiti Island, and upgraded the bridge to a double-double configuration. And today, the bridge-within-a-bridge is called "Echo Bridge" by the residents of Haiti Island.

Lieutenant Colonel Craig is chief of the Combat Arms Division for Readiness Group Seneca. He has previously served as a battalion executive officer and S-3, and has commanded four engineer companies. He holds master's degrees from Central Missouri State University and the University of Alaska. He is a graduate of Command and General Staff College.

Major Smith is commander of Echo Company. He previously served in the New York Army National Guard as an infantry and Special Forces officer. He received his commission from Alfred University, and is a graduate of the Infantry Officer Advanced Course.

Master Sergeant Bates served as the chief enlisted advisor for the Engineer Branch, Readiness Group Seneca, during the bridge project. He is now retired. He previously served as operations sergeant and a platoon sergeant for the 10th Engineer Battalion. He also served two combat tours in Vietnam.

Book Review

First Across the Rhine, by Colonel David E. Pergrin with Eric Hammel, 347 pages, Ballantine Books, New York, 1990.

Colonel Pergrin graduated from Pennsylvania State University in 1940 with a degree in civil engineering. After graduation, he was commissioned a reserve second lieutenant in the Corps of Engineers. When called to active duty in April 1941, he reported to Fort Belvoir, Virginia, for assignment to the Engineer Training School. After several training assignments, Pergrin transferred to Camp Swift, Texas, where he joined the 291st Engineer Combat Battalion, the unit *First Across the Rhine* is about. He wrote this book with Eric Hammel, a professional historian.

COL Pergrin had two purposes for writing the book. First, he tells the history of the 291st Engineer Combat Battalion, from its activation early in World War II until the end of that war in Europe in 1945. Second, he shows how a well trained, well led, and physically fit unit functions effectively in combat.

COL Pergrin describes the formation of the 291st Engineer Combat Battalion and its early days at Camp Swift. The unit initially consisted almost entirely of new soldiers and second lieutenants. While this presented many challenges, it also gave the battalion commander and COL Pergrin (then a major and the battalion executive officer) much flexibility. Junior enlisted men with potential were promoted rapidly. Officers were rotated from position to position to determine which were best suited for each billet.

During their time at Camp Swift, the chain of command stressed demanding and physically challenging training. Upon completion of training, the 291st received very high ratings in both unit training and physical fitness tests. When the unit was ordered to prepare for overseas movement to Europe, Pergrin, a 26-year old major, assumed command.

After the battalion arrived in England, MAJ Pergrin continued to stress demanding training. He emphasized communications within the unit and independent decisions by junior leaders. Soldiers were cross-trained to perform more than one job within their squad. He continued to rotate officers between positions. His goal was to ensure that when the battalion went to the mainland of Europe, each leadership position would be occupied by the most qualified individual.

For the remainder of the book the author describes the exploits of the 291st during its march across Europe. Underlying themes include the soldiers' devotion to the unit and the initiative of the battalion's junior leaders. The battalion's involvement in two critical incidents are explained in detail. The first was the 291st' participation in the Battle of the Bulge, in December 1944. They established and maintained roadblocks and destroyed key bridges in the path of Kampfgruppe Peiper. These actions were critical in stopping the German breakthrough.

The second incident concerned bridging the Rhine River. The battalion, with the assistance of several other engineer units, built the first float bridge across the river near the heavily damaged Ludendorff Bridge at Remagen. This action contributed to the successful penetration of the First Army into the heart of Germany. COL Pergrin describes the 291st' movement across Germany until the European war ended in May 1945.

The author convincingly shows the relationship between training, leadership, and unit effectiveness in battle. COL Pergrin performed a great service to the Army by recording and preserving a first-hand history of the 291st.

This book is applicable to today's Army. It reinforces the timeless concepts of challenging training, effective leadership, and team building, and their impacts on unit combat readiness. It also vividly portrays engineers in close combat with the enemy (as both engineers and infantry) in modern warfare. I highly recommend this book to Army engineers and those in combat arms who may operate with engineers.

By Major Boyd D. Houck, doctrine developer, U.S. Army Engineer School.

Engineer Problem

This is the last of four Engineer Problems dealing with breaching operations. The problems reflect concepts outlined in FM 90-13-1, Combined Arms Breaching Operations, *which was distributed in February 1991. Previous issues of* ENGINEER *included Engineer Problems on the following breaching operations: in-stride (January 1991), deliberate (April 1991), and assault (July 1991). This problem focuses on a covert breach.*

The scenario depicted in each problem illustrates specific teaching points on that type of breach. An excerpt from FM 90-13-1 describes the characteristics of the breach and when it will be used. The problem-solving process is presented using the engineer estimate process and includes some key discussion points.

COVERT BREACH

Problem: You are the platoon leader of 3d platoon, Company A, 21st Engineer Battalion (3/A/21), attached to Task Force Bayonet, a light infantry battalion task force (TF). TF Bayonet's mission is to secure Objective (Obj) Polk, clear Sandt Road, and pass an armored task force (TF Steel) down Sandt Road to the east. As the task force engineer of TF Bayonet and the engineer platoon leader, you are to recommend a task organization of engineer assets to the task force commander.

Task Organization: TF Bayonet consists of one light infantry battalion, two stinger teams, and your sapper platoon.

Enemy:

Terrain. Spur Ridge (Figure 1) is the dominant terrain feature in TF Bayonet's zone. Due to the dense vegetation on Spur Ridge, no significant advantage is achieved by securing the ridge, except for possible use in air defense operations. Thick vegetation and restrictive terrain prohibit cross-country movement in zone, and keep wheeled or tracked movement to existing roads and trails. Small streams cross the area. The terrain favors light infantry operations.

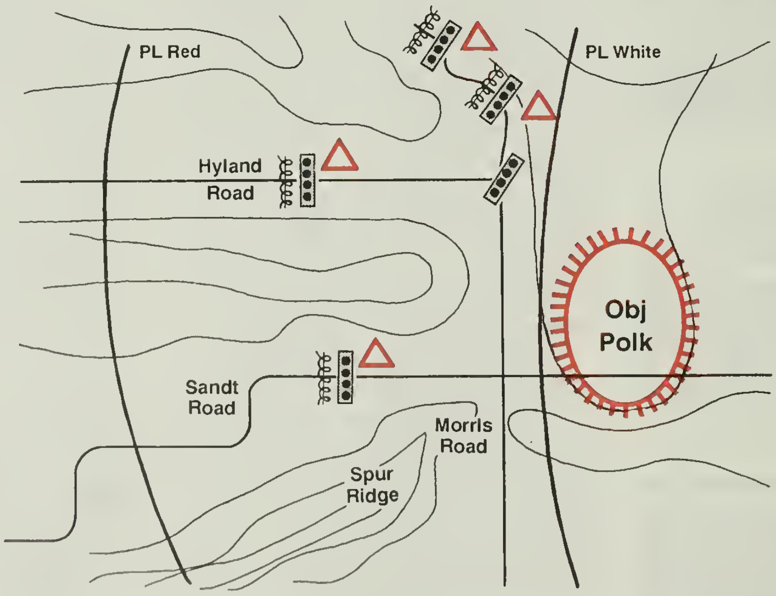


Figure 1

Engineer Problem

Enemy Activity. A threat airborne regiment (-) is conducting a guard force mission in your division's sector. Four threat companies (-) from the airborne regiment are defending in your division's sector. A threat company (-) dug in on Obj Polk has been there for at least 90 hours, and their strength is estimated to be at 60 to 70 percent. The threat is armed with assault rifles, medium machine guns, rocket-propelled grenades, and their organic BMDs, which are dug in. The threat on Obj Polk is in range of the regiment's mortar battery and a supporting regimental artillery group (RAG).

A four-man sapper team from your platoon was attached to the battalion scouts. They assisted in conducting reconnaissance of the battalion's infiltration lanes, roads in the task force sector, and Obj Polk. The reconnaissance team reported the following information to the tactical operations center (TOC):

- No obstacles were found on the dismounted infiltration lanes.
- Obstacles were located on the three roads in the task force sector (Figure 1).
- A wire/mine obstacle is positioned at a choke point on Hyland Road. It consists of 15 rolls of concertina that are staked down with barbed wire, and a surface-laid TM-62M row anti-tank (AT) minefield. The minefield, which is located directly behind the concertina, is about 12 meters deep, goes completely across the road, and is tied into the trees on both sides. This wire/mine obstacle is secured by a two-man listening/observation post (LP/OP).
- Morris Road has the same type of obstacle set up in two locations, approximately 500 meters apart. The recon team noted that the positioning of these two obstacles enables the two LP/OPs to secure them very effectively.
- Another wire/mine obstacle with the same configuration is approximately 1000 meters west of the objective on Sandt Road. It appears that at least one of the BMDs on the southern side of Obj Polk can observe and place direct fire on this obstacle. An LP/OP also secures this obstacle.
- A surface-laid row minefield of TM-62M mines is at the intersection of Hyland and Morris Roads. It consists of two rows with alternately spaced mines. Together, the two rows are about 100 meters long and 20 meters deep. The LP/OPs on both Hyland and Morris Roads and some positions on Obj Polk can observe this minefield.
- No anti-personnel (AP) mines were observed at any of the obstacles on roads in the sector. All of the observed mines were surfaced laid, and there was no indication that any had been buried.

Objective Polk. Objective Polk is situated on very restrictive terrain that is covered with heavy vegetation. The southern end of the objective physically secures Sandt Road and prevents any vehicular movement on the road. A protective obstacle belt encircles Obj Polk. It consists of an AP minefield, a triple-strand concertina fence, and tanglefoot. The only significant break in this belt is where Sandt Road crosses the objective.

The AP minefield is about 15 to 20 meters wide and lies from 20 to 75 meters in front of the fighting positions. All of the AP mines appear to be surface laid, and some have trip wires. The sapper (recon) team leader recognized one of three AP mines at the objective as a POM-Z mine. Trip wires attached to the POM-Z type mines are tied in with the concertina fence, and some are strung into the tangle foot.

One type of mine he did not recognize is small, round, and fairly flat. The mine appears to be about 5 inches in diameter and 2 to 3 inches tall. It has a black cover, and something like a small stem sticks out about 1 inch on one side. The majority of mines in the AP minefield are of this type, and they are surface laid in a random pattern.

The last visible, unrecognized type of mine is placed about every 30 to 50 meters around the perimeter, behind the tangle foot. These mines look like olive-drab dinner plates standing on end, and they are about 10 inches in diameter and 3 to 4 inches thick. The sapper team leader believes that

Engineer Problem

they are some type of directional mine, due to their employment.

The triple-strand concertina (TSC) fence is laid on the far side of the AP minefield. Metal pickets hold the rows in place. The fence is anchored with barbed wire, which is strung on top of the two base rolls of concertina and tied off either to the bottom of the pickets or to one of many trees on the objective.

On the near side of the AP minefield is the tangle foot obstacle, which is about 10 meters wide. It is well camouflaged and is tied into the AP minefield.

Two anti-vehicular wire obstacles and a point minefield block Sandt Road where it passes through the objective. These wire obstacles consist of 15 rolls of concertina that are staked down with barbed wire. They are about 70 meters apart. Between them is a surface-laid minefield that has about 10 TM-62M mines. Threat soldiers have been observed physically picking up these mines and moving them, allowing vehicles to come and go from the objective. These mines do not appear to have any anti-handling devices.

The scouts found two places in the perimeter where dismounted patrols enter and exit regularly. One opening is located in the north and one in the south. Once a patrol passes, a makeshift gate made of two stacked rolls of concertina is slid back to close the opening in the TSC. A footpath appears to have been trampled down in the grass by threat patrols passing through the other perimeter obstacles.

The scouts counted six BMDs dug into hull defilade, oriented to the northwest. Single rolls of concertina appear to divide the objective into three sub-objectives. All of the fighting positions on the objective are well camouflaged and have at least 12 inches of overhead cover.

Divisional long-range surveillance elements have located the threat's regimental command and control site in the eastern part of your division's sector. It is protected by six T-62s and five BMPs. This force has about a 20-minute response time to react to any of the four threat companies in your division's sector.

Mission: Control of Objective Polk will allow your brigade to pass TF Steel through your battalion, and move down Sandt Road to attack the threat's regimental command and control site. The brigade commander's intent is for your task force to quickly secure Obj Polk, clear Sandt Road, and conduct a forward passage of lines of the armored task force. The attack must be conducted so that the armored task force can rapidly attack deep to destroy the threat command and control site before the threat can react.

Commander's Intent: The critical elements of this operation are the silent infiltration of TF Bayonet and the total surprise of the threat on Obj Polk. When TF Bayonet initiates their assault on Obj Polk, they must control the southern end of the objective before the threat reacts. TF Bayonet must quickly secure Obj Polk, rapidly breach all obstacles on Sandt Road, and pass TF Steel to the east so they can attack the threat regimental headquarters. After passing TF Steel, TF Bayonet will clear the last threat elements from the northern end of Obj Polk. Remember, the timing and speed of TF Steel's passage are critical.

Execution: The task force commander selects the scheme of maneuver shown on the Task Force's Operations Overlay (Figure 2, page 27) The operation for TF Bayonet will consist of four phases:

Phase 1 - Infiltrate into assault positions and continue interdictory fires.

Phase 2 - Conduct a covert breach and assault to seize the south side of Obj Polk.

Phase 3 - Pass TF Steel.

Phase 4 - Complete seizure of Obj Polk.

Phase One. TF Bayonet takes advantage of the restrictive terrain and darkness to infiltrate their force. The task force crosses the line of departure (LD) with company A in the lead, followed by Companies C and B in echelon. Company A and one stinger team infiltrate on lane North and occupy their assault position. Companies C and B infiltrate in echelon along lane Spur to assault positions C and B, respectively. The last stinger team moves with Company B and is left in position on Spur Ridge. Scouts locate bypasses to all obstacles and wait to link up and guide the companies into their assault positions. All three companies are prepared to conduct covert breaches of unexpected obstacles during Phase 1.

Engineer Problem

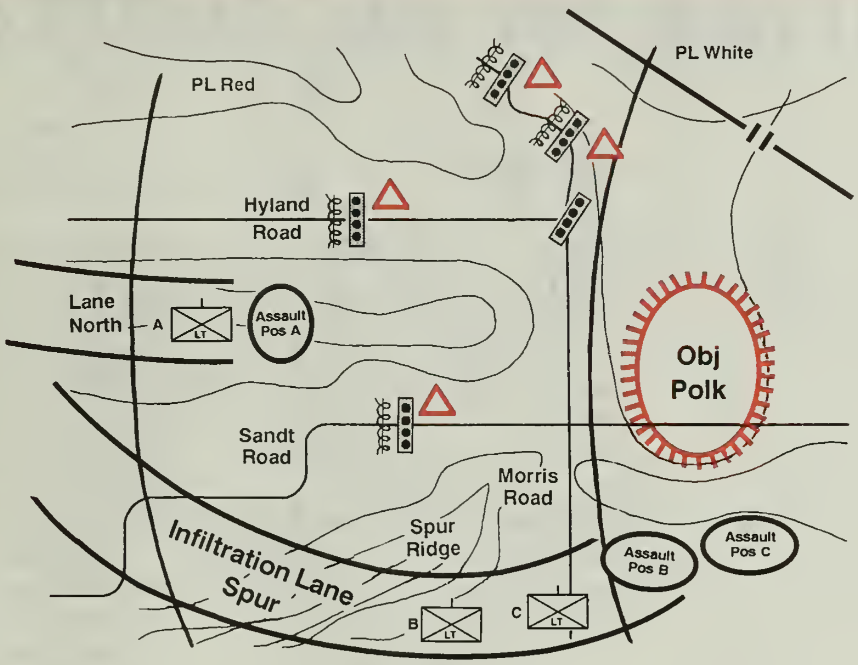


Figure 2

For the previous 48 hours, division artillery assets have conducted interdictory fires, smoke, and illumination throughout the brigade sector. These fires randomly target all known threat obstacle sites and objectives. The fires began before the infiltration, and they will continue until the actual assault on Obj Polk begins.

Phase 1 is complete when the three companies occupy their assault positions.

Phase Two.

- Company A occupies their ABF position and moves an element into position to breach the obstacle on Sandt Road.

- Company C moves out of their assault position (Figure 3, page 28) and into the selected breaching locations on Obj Polk.

- Company B moves into position so that, on order, they can pass through Company C and continue the attack on Obj Polk.

- Divisional interdictory fires are shifted from the southern end to the northern end of the objective. These fires have continued for almost three days. The intent is that, after almost three days of interdictory fires, lifting and shifting them around or off the objective will not raise threat suspicion, and will help mask TF Bayonet's actions.

- Company C conducts a covert breach on Obj Polk. They plan to use the southern path made by the threat dismounted patrols to enter and leave Obj Polk. The sappers who located this path will guide Company C soldiers to it. If the covert breach is detected, Company A will execute direct and indirect fires on the northern end of the objective in order to isolate the southern part. When Company C begins its assault, all planned suppressive and obscuring fires are initiated. These fires are directed at the northern end of Obj Polk to isolate the breach site and support the assault force.

- As the assault begins, an element of Company A breaches the obstacle on Sandt Road and eliminates the LP/OP (overwatch) position.

Engineer Problem

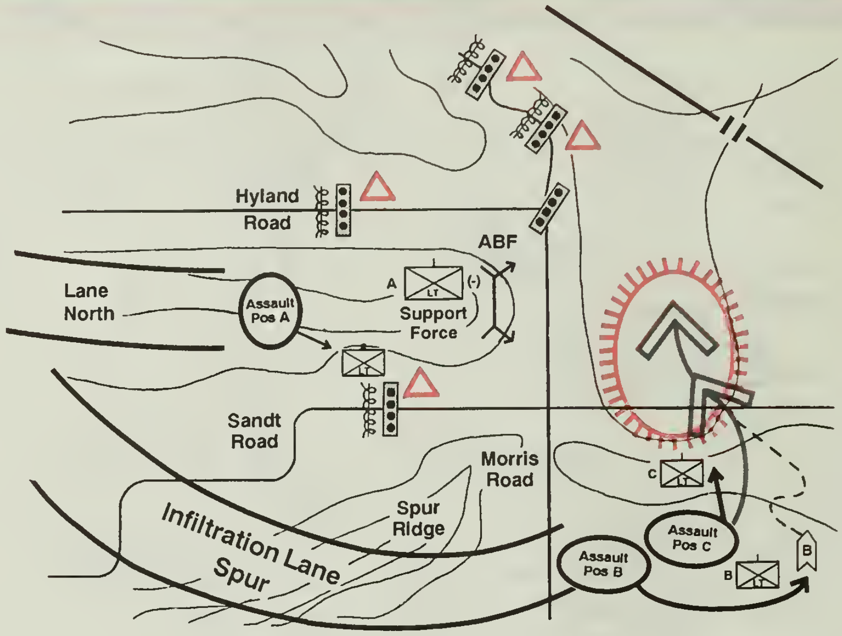


Figure 3

- After the southern end of the objective is secured, Company A lifts its fires and Company B passes through to secure the rest of Obj Polk.

Phase Three. On order, TF Steel passes through TF Bayonet on Sandt Road to attack and destroy the threat regimental command and control site. A speedy passage is critical to ensure the attacking force surprises the threat. TF Steel must pass through as soon as Sandt Road is open, during the final phases of the assault on the Obj Polk.

The commander of Company C informs you that he will assault Obj Polk with two platoons. The task force commander asks you to recommend a task organization to support this mission.

COVERT BREACH DESCRIPTION

Definition: A unit conducts a covert breach when stealth, surprise and quiet obstacle reduction techniques are required by the maneuver plan.

Application: A covert breach applies some characteristics of the other three types of breaching operations (assault, deliberate and in-stride). However, the planning and execution fundamentals used to suppress, obscure, secure and reduce (SOSR) are significantly different. Consequently, a covert breach must be separated from the other three breaching operations to ensure its success.

The main difference is the critical element of surprise required for a covert breach. In an assault, deliberate, or in-stride breach, the attacking force immediately applies overwhelming combat power to overcome the threat. In a covert breach, the attacking force stealthily prepares lanes and positions for the assault and support forces, taking care not to attract the threat's attention. The element of surprise delays threat reaction until the breach lanes are open and the assault is in progress.

In this problem, if the threat detects the covert breach, TF Bayonet is prepared to execute an assault breach. A key decision is where the assault breach will be initiated: Will the assault breach begin where the covert breach force is located, or will the covert breach force pull out and move to a different location? The transition from a covert to an assault breach must be explicitly rehearsed by all members of the combined arms team to ensure success.

ENGINEER Solution on page 43.

PRIME POWER ON THE BATTLEFIELD

By Major Kenneth E. Cockerham

Who has responsibility for the continuum of electrical power on the battlefield? First asked by chief of engineers, Lieutenant General Henry J. Hatch, this question appears to have a straightforward answer: "Tactical units have tactical generators, all others rely on available commercial power."

In reality, power requirements in the theater of operations are much more extensive and complex than this simplistic response indicates—a fact of life that quickly became apparent during the early stages of Operation Desert Shield. In fact, tactical generator (TACGENS) power and reliable commercial power are at opposite ends of the battlefield electrical power spectrum—and there is a large gap between the two. To fill this gap, the Army formed new prime power units to meet a host of critical electrical supply needs.

Prime power engineers work with local Iraqi electricians to restore power to Dihok, Iraq .

The rift between TACGENS and commercial power occurs when commercial power is not available and TACGENS power is not suited for a particular application. It also occurs when commercial power is available but limitations on the existing distribution system preclude its desired use.

An overview of the pros and cons of TACGENS and commercial power illustrates the need for the prime power units.

TACGENS

TACGENS power is well suited for use in remote areas for relatively light electrical loads. Such generators are available in sizes up to 200 kilowatt hours (kw). Some TACGENS are capable of being installed and operated in parallel to provide more power to a larger load. They are relatively small, light, mobile, and can be easily installed and operated. They can be connected to provide a variety of output voltages, both single phase and three phase. TACGENS also provide a robust power source, since failure of one generator doesn't cause widespread power failure. The disadvantages of these generators include:

- *Limited output capacity.*
- *No long-term reliability.* The yardstick for power system reliability is the ability to meet the power demands of all users without failure for a long period of time. TACGENS are not designed to be operated continuously for long periods.

Staff Sergeant Kelly Revell, right, a prime power technician, makes adjustments to a power line while a Navy Seabee looks on.

Fluctuating power quality. Clean power maintains constant output voltage, frequency, and AC (alternating current) sinusoidal waveform over a wide range of load and usage conditions. TACGENS are susceptible to voltage, frequency and waveform deviations during load swings.

- *Burdensome logistical requirements.* TACGENS have significant maintenance and fuel requirements.

Commercial Power

Commercial power is produced by stationary power plants and distributed on a permanent transmission and distribution network called a power grid. Power plants may be of various types: hydroelectric, fossil fuel or nuclear-powered steam, gas turbine, or diesel.

The major advantages of commercial power are high reliability and low maintenance (after construction of the grid). Commercial power is considered to be a highly reliable source of clean electrical power. "Clean" means that the AC frequency is constant and that voltage is relatively constant, even during sizable load swings.

Once installed, commercial power requires little or no maintenance by the user. User fuel requirements are eliminated. Commercially produced power usually has enough capacity to carry very large electrical loads.

Disadvantages of commercial power include:

- *Regional availability.* Commercial power is frequently not available in remote locations. In some contingency theaters, it may not be available at all.
- *Less flexible.* Commercial power is usually tied to previously developed, fixed facilities. Significant construction and materials are required to deliver commercial power to new locations. Extensive technical expertise and skill are also required to connect commercial power to new users.
- *Vulnerability.* Commercial power plants and their associated power grids are vulnerable to acts of sabotage. Because of their long expanses, transmission lines are particularly difficult to protect from this threat.
- *Less Robust.* Damage to power plants or to the power grid may cause extensive and widespread power outages. Repair of these damaged facilities can be time consuming.
- *Voltage and frequency incompatibility.* In some theaters, voltage and/or frequency of commercial power are not compatible with the users' equipment.

Prime Power in the Gulf

The need for prime power support was recognized early in Operation Desert Shield. With the rapid development of the theater of operations, coalition forces required more and more power. To provide the needed electricity, war planners recognized that they needed soldiers with the technical expertise and equipment to expand the commercial power grid, and install and operate power plants.

Initially, some desperately needed electrical work was accomplished by civilian contract labor. But skilled civilian manpower was scarce and expensive. Workers were also understandably reluctant to work very far forward because of the threat of hostilities.

Too, contracted work was not very responsive because of lengthy contracting procedures. This situation was exacerbated by a shortage of military personnel who had the technical expertise to write electrical contract specifications.

In late August 1990, Desert Shield planners sent a request to Forces Command (FORSCOM) for a unit which could accomplish the necessary electrical work. While acting on the request, FORSCOM found that no such specialized unit was prepared for the job. Only through extensive efforts on the part of the Prime Power Directorate of the Army Engineering and Housing Support Center (USAEHSC) (a USACE field operating agency) was a prime power unit designated and scheduled for deployment.

This unit was the 535th Engineer Detachment, formerly a power generation unit, headquartered at Fort Monmouth, New Jersey and commanded by Major (then Captain) Dale Knieriemen.

In September 1990, a 16-man prime power team deployed to Desert Shield from Fort Bragg. The team consisted of elements of the 535th Engineer Detachment which had been stationed at Fort Bragg, Fort Monmouth and Fort Campbell. Personnel from the Prime Power Directorate at Fort Belvoir were also deployed with the unit. The team shipped 16 750kw generators and a large quantity of power distribution and transformer equipment. Though the team arrived in theater far ahead of its equipment, it went to work immediately, expanding the commercial grid and delivering power where it was needed.

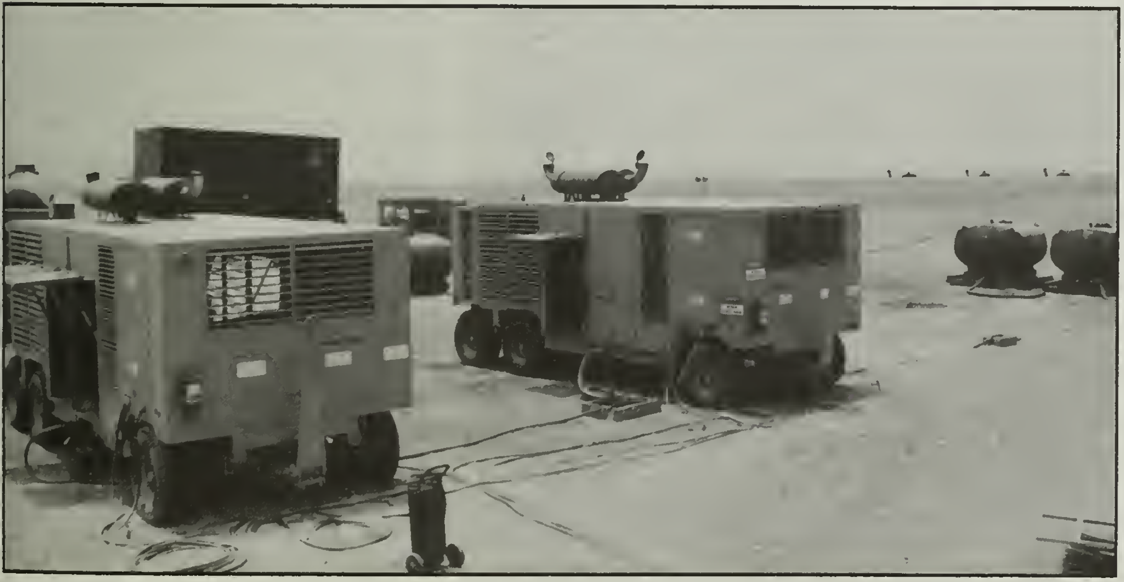
But the tremendous demand for prime power services and expertise soon overwhelmed this small team. In November a second team from the 535th was deployed to reinforce the effort. This team, from Fort Benning, was made up of personnel from the 535th, and from Detachment II and Detachment IV, two TDA prime power detachments.

Throughout Operation Desert Shield and well into Operation Desert Storm, these two prime power teams were the only soldiers in the theater of operations with the expertise and equipment to "bridge the gap" between TACGENS and commercial power. Since no doctrine existed which established control and utilization of prime power teams, the 535th commander found it necessary to educate other engineers on the mission, capabilities and role of his unit. He had to institute the proper command and support relationship which would allow him to support the entire theater with the small prime power force.

Through trial and error, he and the theater engineer found that prime power units, to be most effective, must be retained as theater assets and work directly for the regional wartime construction manager (RWCM)—the senior engineer commander.

The two prime power teams continued to carry an enormous workload throughout Desert Shield. In December 1990, the theater requested that two more prime power teams be deployed.

The Prime Power Directorate of USAEHSC had anticipated this request and had already created Task Force Bravo (Prime Power). The task force was made up of personnel from TDA prime power detachments at Fort Bliss, Fort Lewis, Fort Bragg, Fort Leonard Wood, and Germany. The task force was configured with two 16-man teams and a command and control headquarters. Its mission was to reinforce the 535th



The prime power plant at the west heliport, Dhahran Airbase, Saudi Arabia. Each generator produces 750 kilowatts.

Detachment prime power teams.

Conflicting deployment and transportation priorities delayed the deployment of Task Force Bravo until late February 1991. By the time Task Force Bravo arrived in theater on March 1, Kuwait was liberated and the cease fire was in effect.

However, the liberation of Kuwait did not diminish the theater's need for prime power support. Power was still required at Patriot missile sites, evacuation hospitals and major command and control centers. Elements of the 535th, now reinforced by Task Force Bravo, were heavily involved in damage assessment and restoration of emergency power in Kuwait. Prime power experts were even called upon to provide power for the peace talks between coalition leaders and Iraqi representatives.

With the war won, the theater's main effort quickly turned toward redeployment of troops and equipment. In April, the 535th returned to their home stations, and Task Force Bravo assumed responsibility for prime power support to the theater. New aerial ports of embarkation were constructed at Dhahran and other sites, and power was provided to these facilities by Task Force Bravo.

Major new projects requiring prime power expertise arose almost daily. These projects involved repair, maintenance and new construction of power distribution systems, as well as power production. In May 1991, when the overall redeployment schedule was published, Task Force Bravo was slated for an August redeployment.

But in late May, Task Force Bravo was assigned to support the relief efforts of Operation Provide Comfort. The task force executive officer and one NCO electrician were sent to northern Iraq to repair a generator at a hospital in Zahko. They were also assigned to assess the need for additional

— Prime Power Scenarios —

Some theater operations require prime power assets because of location, specialized equipment, or other circumstances. The following scenarios highlight some situations where prime power is the best—and sometimes only—choice.

Situation: A major command and control headquarters is located in a fixed facility in the COMMZ (communications zone). The facility is powered by the commercial grid. Power must be provided to support units located in temporary facilities close to the headquarters. Prime power teams can tap into the commercial grid, design and install an expansion to the distribution system, and provide needed power to these support units and activities. They can also provide reliable emergency backup power to the headquarters in the event of commercial power outage.

Situation: Patriot missile batteries require continuous, reliable power for their systems. But they are seldom deployed to areas with readily available commercial power. Their on-board TACGENS require heavy maintenance and repair. Prime power personnel can design, install and operate a reliable power system using 60 to 400 hertz converters, greatly enhancing the reliability of these critical missile systems.

Situation: Theater engineers construct critical facilities such as life-support areas, prisoner of war camps, aerial ports of debarkation/embarkation, equipment maintenance and wash facilities, and rest and recreation complexes. These are often constructed in remote areas. Prime power teams can design and install power distribution systems for these facilities. They can tap into a commercial grid or install and operate power plants to produce large quantities of reliable electricity.

Situation: U.S. Army Evacuation Hospitals rely on organic 100kwh TACGENS for power. After months of continuous running, the TACGENS' reliability is diminished. Prime power units can install a replacement power plant and distribution system, allowing the hospital's TACGENS to be used for backup power.

Situation: In the aftermath of war, Kuwait's ability to provide commercial power was non-existent. Prime power soldiers can go in immediately behind liberation forces, assess damage to the power grid, repair backup generators in critical facilities such as hospitals, airports, and government buildings, and restore emergency power to these critical facilities. They can then work with civilian engineers to make expedient repairs to large commercial power plants, and bring them back on line.

Situation: An area support battalion (ASB), with many of its subordinate support units, occupies a fixed facility in the COMMZ. The facility is powered from the commercial grid. Due to overloaded circuits and substandard or nonexistent host nation electrical safety codes, a serious electrical fire hazard is created. Prime power units have the technical expertise to evaluate and fix this dangerous condition.

Situation: Iraqi forces damaged or destroyed the infrastructure of several Kurdish population centers in northern Iraq. A significant element of the subsequent U.N. relief effort was the restoration of basic utilities, including electrical power. Prime power teams have the knowledge of power systems and the technical expertise to assess the damage, and restore emergency power to hospitals, water pumping stations and even entire cities.

Prime power team member Sergeant Sidi Hassaneodin opens a fused disconnect on a medium voltage distribution network.

prime power support. Initially expecting to be gone only a week, the two were kept busy for 54 days. During this time, they not only fixed the generator but also restored emergency power to several other critical facilities and the entire city of Dohuk, a community of over 320,000 people.

As Task Force Bravo's scheduled redeployment approached, the theater recognized that it could not do without the services provided by the prime power teams. In June, the theater requested a prime power team to replace Task Force Bravo upon its redeployment. On August 1, 1991, a prime power team from Fort Leonard Wood arrived in theater and assumed mission responsibility from Task Force Bravo on August 19. The team redeployed to home station in January 1992.

Out of simple necessity, prime power teams were stationed in the Gulf theater of operations longer than any other engineer unit. No other unit had the technical expertise to perform the critical power missions handled by the teams. Lieutenant Colonel William Vogel, commander of the 864th Engineer Battalion (C)(H), said, "Prime power soldiers were absolutely the experts in power generation and distribution for the entire theater of operations. They accomplished every mission given them. Their performance was magnificent. No one else could have provided the critical support and services they provided."

Prime power soldiers were recognized as experts in their field. Prime power units completed more than 300 power-related missions in the Gulf theater. They produced over 10 million kilowatt hours of reliable, commercial-grade electricity, using their organic equipment. Prime power units proved themselves an essential element of sustainment engineering operations.

What's Next?

The critical need to bridge the gap between TACGENS and commercial power was clearly identified in the Gulf War. The coordinating draft of FM 5-422, *Engineer Prime Power Operations*, is now under review. Other doctrinal literature and practices must also be updated to reflect the role and proper utilization of prime power assets across the operational continuum.

Prime power doctrine also needs to be integrated into higher level doctrine and published in revisions of Field Manual (FM) 5-104, *General Engineering*, and FM 5-116, *Engineer Operations: Echelons Above Corps*. It also needs to be included in new doctrinal publications such as FM 5-114, *Engineer Operations Short of War*.

The prime power organization must be tailored to support future military operations. On July 23, 1991, the chief of engineers granted authority for the Prime Power Directorate of USAEHSC to reorganize into a provisional engineer battalion. This reorganization is the first step toward the formation and activation of a TOE (tables of organization and equipment) prime power engineer battalion. This battalion will provide the technical expertise, equipment and manpower to close the rift between TACGENS and commercial power.

It should also give a solid answer to General Hatch's question.

Major Cockerham is currently writing prime power doctrine at the Engineer School on a detail assignment from the provisional prime power battalion. He previously served as commander of Task Force Bravo (Prime Power) in the Gulf War. Other assignments include commander of Prime Power Detachment II; engineer advisor to Readiness Group Jackson, and company commander, executive officer and platoon leader for the 4th Engineer Battalion. He holds a master's degree in electrical engineering from the Naval Postgraduate School.

ERI Adds Agility to the Engineer Force

By Lieutenant Colonel Roger J. Somerville

Combat engineers are on the bow wave of changes occurring within our Army's doctrine and organizations. Efforts by the Engineer School to make engineers full players on the combined arms team resulted in approval of the Engineer Restructure Initiative (ERI) by the Chief of Staff of the Army on 5 March 1991. This long overdue reorganization benefits the combined arms forces and will eventually be integrated into the Total Army.

Unfortunately, non-supportive remarks by engineer officers in the field and at higher level staffs could undermine ERI as it is being implemented. These comments reflect a lack of understanding about the ERI reorganization. I feel we must all stop complaining, learn about the reorganization, work to make the transition occur smoothly, and document any shortfalls discovered during the process.

Echelon Of Engineer Forces

Under the ERI concept, engineers are organized in three distinct echelons: division, corps, and echelons above corps. These units have different type missions and organizations. Up front with the infantry and armor units are engineers "at the point of the spear." They are the sapper companies and battalions that "clear the way" and provide mobility for the maneuver forces.

Combat engineers at corps have a broader mission based on the corps commander's intent in the fight. They may fight forward with the divisions, work in the division rear area, or work in the corps rear area. These corps combat engineers must be able to perform topographic, mobility, countermobility, survivability, and sustainment engineering missions. They are combat engineers with sapper skills, but they have more equipment and a larger organization to execute the tactical and more technical missions.

Engineers at echelon above corps are focused on the construction of airfields, ports, bridges, and roads. They provide sustainment engineering to units that sustain the fighting forces. At times they will go forward into the corps or division rear areas to help the division sappers or corps combat engineers complete their survivability or sustainment missions.

ERI Concept

In Southwest Asia (SWA) the Army proved it is a very lethal force. Once deployed into the area, it proved it could move quickly on the battlefield if there were no threat or terrain mobility restrictions. To keep up with this fast-moving lethal force, the engineers in SWA developed an ad hoc command and control structure using division and corps engineer assets. We have been doing the same things in Germany for years. ERI fixes this command and control shortfall. In accordance with AirLand Battle (Future) or AirLand Operations, ERI organizations at division are focused on fixing the command and control and logistics shortfalls, and providing mobility to the force over expanded areas of operation.

With ERI, we have a mechanized sapper battalion habitually associated with each division armored (mechanized) maneuver brigade. This sapper battalion commander is the brigade engineer. He will organize his headquarters to synchronize engineer missions throughout the depth of the brigade battlefield. His battle planning staff will be integrated into, and collocated with, the maneuver brigade battle staff. The battalion will have the capability to quickly integrate additional engineer assets into the brigade's operations.

Also, a sapper company will habitually associate with an armored (mechanized) battalion task force. The training and wartime integration provided by this association will promote a better understanding of each unit's capabilities and the commander's intent in all operations. This is how most units preparing for training rotations at the National Training Center (NTC) or Combat Maneuver Training Center (CMTC) do it. ERI will now provide better engineer responsiveness and greater flexibility to engineer operations at the task force and brigade levels.

Echelons Above Brigade

The new engineer brigade commander at division level is the division engineer (DIVEN). The sapper battalions organic to this engineer brigade are initially attached to their habitually associated maneuver brigades. The division engineer will organize his headquarters to plan and synchronize all engineer missions conducted across the entire division's battlefield area. Representatives from the DIVEN headquarters detachment (HHD) will be at the division tactical command post and the main and rear command posts.

Usually the division engineer will receive corps engineer units and direct the execution of their specific missions. These units may assist in setting up a deliberate defense, assist in conducting a deliberate breaching operation, provide additional support to a main effort, assist in conducting a river crossing, or provide sustainment engineering in the division rear area.

The corps engineer will influence the corps commander's fight by sending units to the divisions, or by employing them in the corps rear area. If a corps combat engineer battalion is tasked to a division, it will almost always operate as a complete battalion, with the combat engineer companies receiving all orders from their parent headquarters. Corps combat support equipment companies may be attached to combat engineer battalions to provide additional horizontal construction capabilities, or they may be sent forward to support a division.

Most combat heavy engineer battalions (which are more appropriately called combat construction battalions) will be organized at echelons above corps. This does not mean they cannot work in the corps area. The division and corps engineers will request these units to support their requirements and missions.

Engineer Battlefield Missions

The engineer battlefield missions and associated critical tasks determine the engineer organization and equipment required in the new units. The sapper battalions will provide mobility and survivability (M/S) to the maneuver brigades. (Note that countermobility is considered a component of mobility in TRADOC Pamphlet 11-9, "Blueprint of the Battlefield," a battlefield operating systems (BOS) model). These sapper battalions will be outfitted with vehicles and equipment that can keep up with the maneuver forces on offensive operations. They will also support the requirements to construct combat roads and trails for the maneuver forces and combat service support elements, and to place flank and frontal tactical obstacles.

When the maneuver brigade transitions to the deliberate defense, corps combat engineer battalions and combat support equipment companies will move forward to assist the sapper battalion. They will provide additional countermobility, survivability, or sustainment engineering required in preparing the defense. When those missions are completed, corps units will move to other corps priorities.

The armored division sapper battalions are new engineer organizations that focus on providing mobility. They are not organized the same as the old J-series division battalions. These sapper battalions improve the engineer command and control by integrating into the maneuver brigade, adding the flexibility engineers have been missing in the M/S BOS. They can be task organized within the division just like any of the mechanized or armored battalions. They can receive other engineer units and quickly integrate them into the engineer work effort.

The corps combat engineer battalions may receive any of the engineer missions. They must be balanced and flexible organizations that can move quickly around the battlefield to accomplish their missions. In most cases they will operate behind the brigade rear boundary, using the existing road network. Here the wheeled units will have a mobility advantage over the tracked units. We must ensure the corps combat engineer battalions retain the all-purpose, flexible engineer organizations that we had in the past and that have traditionally been the engineer combat multiplier on the battlefield.

Building And Training ERI

Combat developers at the Engineer School used the ERI concept just described to produce a table of organization and equipment (TOE) for the units. FORSCOM or appropriate major commands then developed modified TOE (MTOE) organizations based on the projected resources available.

Engineer commanders of field organizations will be challenged to make the MTOE structures work. It is essential that unit leaders exercise these MTOE to find their strengths and weaknesses, document them, and provide input to FORSCOM and the Engineer School. Let us know what works and what you need!

Engineer commanders must train their division and corps units and educate the Army about ERI. Remember, ERI is different—most engineer units do not have the same capabilities as before, and the sapper battalion in armored (mechanized) divisions is a new organization. The muscle to do rear area survivability and sustainment tasks for the division will come from the corps combat engineer units. Be aware that most of these corps units are located in Reserve Component forces. This will demand that division engineers better integrate Reserve Component units into their division's training cycle, which includes taking them to the combat training centers.

Conclusion

The opposing force (OPFOR) at the National Training Center has agility because of their command and control system, well trained soldiers, and well developed tactics, techniques and procedures (TTP). The divisions that trained and fought in Saudi Arabia had agility because they increased their command and control capabilities, and had time to train and learn their doctrine and TTP. With ERI, the engineer force will now add engineer agility to the maneuver force. We have taken a big step forward with our new organizations. The doctrine to fight is out in draft form, and we must train on it at every opportunity.

We are now on the bow wave of changes in the Army with this improved command and control and integrated planning capability. Smaller organizations in the division will make it easier to move engineers laterally on the battlefield. Now it is up to engineers in the field to learn the doctrine, expand on the strengths of the new organizations, discover and document the difficulties, and develop workable solutions. Sappers forward!

Lieutenant Colonel Somerville is a sapper who is currently chief, Tactics, Training, and Doctrine Division, at the Engineer School. He has served with the 177th Armored Brigade at the NTC, two tours with the 1st Armored Division, and one tour with the 82nd Airborne Division. He has a degree in civil engineering from Montana State University and is a certified professional engineer.

The ENGINEER Writer's Guide

We think engineers take a special pride in their profession, and *ENGINEER* is always looking for articles from readers who want to share their expertise, experience and ideas.

If you're a potential contributing writer, here are a few "writer's guide" tips that should help steer you in the right direction:

Articles can cover engineer training, operations or doctrine, engineer equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers—that's what we need.

Articles should generally come from contributors with first-hand experience with the subject being presented.

Avoid theatrical writing styles like: "It was a dark and stormy night...," or "...the soldier blazed through the jungle on his lumbering D7, providing a trail of freedom for the other vehicles...."

Articles should be concise, straightforward, and in the active voice.

Length should range between 2,000 and 4,000 words, and the text should be typewritten and double-spaced. Generally, each such page will contain from 200 to 250 words.

Articles containing attributable information or quotations not references within the story should carry appropriate footnotes.

Manuscripts must be original, unpublished, and not under consideration by another publication. Normally, you can expect a reply to your submission within two weeks after we receive it.

All submissions are subject to editing.

Contributors are encouraged to include black-and-white photos, artwork, and/or line diagrams to help illustrate your article.

Include your full name, rank, current unit and job title. Also include a list of your past assignments, experience and education, your mailing address, and daytime phone number—preferable Autovon. Send your articles to: Editor, *ENGINEER* Professional Bulletin, ATTN: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650.

If you have any questions about an article you're working on—or considering writing—give our features editor, Phil Howell, a call at DSN 676-7643, or commercial (314) 563-7643.

We look forward to hearing from you.

P.S. ENGINEER *welcomes response from our readers. Letters regarding information in our magazine are published in our "Letters to the Editor" department. Let your thoughts be heard.*

The Role of Joint Task Force-Bravo in Nation Assistance

By Major Scott Brubaker

Your unit has just been notified that it will deploy to Honduras. What now? Where do you start your planning? Is there anyone who can help? The answer to these and many other questions can be found at Joint Task Force-Bravo (JTF-B), a subordinate command of the United States Southern Command (USSOUTHCOM).

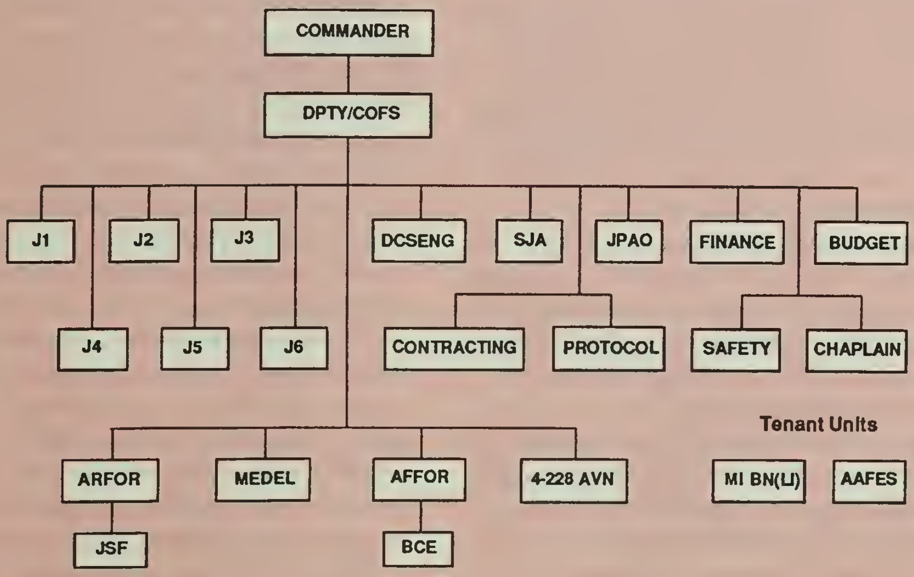
The purpose of this article is to discuss the missions and capabilities of JTF-B and how it assists deploying units to have successful training events in Central America. It is not intended as a definitive "how to" article, but as an overview of what you can expect and things you can do to enhance your unit's deployment.

Based in central Honduras at Soto Cano Air Base approximately 60 miles north of Tegucigalpa, the capital of Honduras, JTF-B is ideally situated to support all U.S. forces exercises. Soto Cano Air Base, home of the Honduran Air Force Academy, is located along the main north-south highway in Honduras and has the only C-5 capable runway in the country. The organization of JTF-B is shown below.

Missions and Capabilities

The JTF-B External Standing Operating Procedures (SOP) provides the following unclassified mission statement: "JTF-B exercises operational control of designated U.S. military forces and exercises area command responsibilities for all U.S.

Joint Task Force-Bravo



Camp Guayacan, a 700-man basecamp in Honduras. Soldiers stationed at the camp were part of Fuertes Caminos 91.

military forces in Honduras to secure unity of effort in all operational missions, ensure compliance with command policy and to coordinate defense, security, logistics and the use of available facilities; ensures effective intelligence coordination to provide all U.S. forces with indications and warnings intelligence; acts as USCINCSO's directive authority in the field of logistics and coordinating authority in Honduras on engineering functions; plans and conducts joint/combined exercises in Honduras as directed by USCINCSO..."

Restated, this simply says that JTF-B is responsible for providing the assistance to make your training in Honduras safe and successful. Key phrases are "providing...assistance" and "your training." JTF-B will not do the planning for you, nor will they tell you exactly how to accomplish the project(s) you've been assigned. They will guide you through the maze of regulatory requirements and provide necessary resources. You will be expected to plan and execute your own training.

The JTF-B primary staff, J-1 (personnel), J-2 (intelligence), J-3 (operations), J-4 (logistics), J-5 (civil-military operations), and J-6 (communications), performs all staff functions normally associated with these positions. Some functions critical to your deployment are worth highlighting.

Units deploying to Honduras operate in a low intensity conflict environment, which makes the J-2's 24-hour-a-day intelligence and Indications and Warning (I&W) support extremely important. This support, along with the advice and guidance of J-3 Force Protection, will help ensure your unit's safety.

The J-3 consists of Operations, Plans, Exercises, Force Protection, and Air sections. J-3 Exercises is the first in-country contact for units deploying to Honduras and provides coordination with other staff sections as well as the Honduran government and military. Much of your unit's movement while in Honduras will be by air. The J-3 Air provides assistance in planning for rotary and fixed wing aircraft support.

Deployment and redeployment can be a daunting experience. The J-4 guides unit planners through the maze of logistics requirements covering port operations, bulk fuel, customs clearance, and support from other JTF-B elements, the U.S. MILGRP, and the host nation. While exercising in Honduras provides training opportunities not available elsewhere, nation assistance is also part of the equation. This is the purview of the J-5, which works to improve the Honduran quality of life and enhance the Honduran and U.S. government images. Assisting units to maintain communications in Honduras is the function of the J-6. This section provides in-country expertise on all communications systems including telephone, radio, and television.

The special staff sections that are important to deploying units include the deputy chief of staff, engineer (DCSENG), contracting, the staff judge advocate (SJA), and the joint public affairs office (JPAO). While the remaining special staff sections are important to the success of any deployment, most units will have little contact with them.

The DCSENG is responsible for all engineer-related exercises, from two-week deployments for training to the engineer phases of JCS-sponsored exercises such as FUERTES CAMINOS and AHUAS TARA. The section allocates projects, assists with material acquisitions and equipment support, oversees quality control, and operates "Engineer Village." This area houses engineer units working on or near Soto Cano Air Base as well as units requiring temporary housing during deployment/redeployment.

Contracting is the point of contact for all in-country material, equipment, and service needs. They purchase materials locally that are unavailable through the supply system or required on short notice, lease vehicles and equipment, and contract for billets and messing in local hotels. The SJA assists units in negotiating real estate leases and settling claims against the U.S. government. Finally, the JPAO ensures deploying units get the media attention they deserve both at home and among the Honduran people.

Subordinate elements of JTF-B are the Army Forces (ARFOR), the Air Force Forces (AFFOR), the Medical Element (MEDEL), and the 4th Battalion, 228th Aviation Regiment.

The ARFOR provides command and control of all U.S. Army elements in Honduras, including U.S. Air Force members of the joint staff, and works closely with deploying units for all in-country logistics support. The Joint Security Force (JSF) provides convoy planning assistance and escort vehicles/personnel when required.

The AFFOR provides command and control of all U.S. Air Force elements in Honduras, except U.S. Air Force members of the joint staff. The base civil engineer (BCE) is responsible for operations and maintenance of all JTF-B facilities, much like an Army DEH. Most units deploying to Honduras will deal with the BCE only when assigned construction projects on Soto Cano Air Base or at other JTF-B remote sites.

MEDEL is responsible for all medical and health activities for U.S. military personnel. They provide assistance in satisfying medical requirements prior to, during, and after deployment. The Preventive Medicine section provides initial preventive medicine briefings to all personnel arriving in Honduras. MEDEL also coordinates medical and dental unit deployments to treat people in remote areas. These medical deployments are often coordinated with engineer deployments to improve sanitation facilities for local citizens.

The 4th Battalion, 228th Aviation Regiment, is a composite aviation battalion that provides UH-1H and UH-60 utility helicopters, UH-60 medevac helicopters, and CH-47 cargo helicopters. Its pilots are a valuable source of information on landing zones and airstrips throughout Honduras.

Training In Honduras

Engineer training in Honduras generally falls under one of two categories: nation assistance projects or exercise-related construction. While the difference between the two is primarily a function of funding and beyond the scope of this article, the following provides a simplified description of the two broad categories.

Nation assistance projects are those that enhance the quality of life for the Honduran people and provide viable training opportunities for U.S. forces. They are typically single service, short-duration projects including well drilling and building/repairing schools, clinics, gymnasiums, community centers, and bridges. Nation assistance projects in Honduras fall under the "1/3 Rule" which simply means that the work force is 1/3 U.S. military, 1/3 Honduran military, and 1/3 Honduran civilian.

The theory behind this rule is two-fold. First, human nature suggests that people tend not to appreciate and take care of things that are simply handed to them. Therefore, it makes sense to have local civilians involved, both to make them feel a part of the project and to teach them the skills to maintain it once completed. Second, having Honduran military participation suggests to the local population that their government, not just the U.S., is doing something for them which contributes to political stability.

Exercise-related construction projects occur during JCS-sponsored exercises and are focused on supporting exercise training objectives which may or may not contribute to the Honduran quality of life. These projects tend to include more than one service and are of longer duration—sometimes, as in the case of EX FUERTES CAMINOS, a period of years. They include construction of basecamps, forward landing strips, roads, POL facilities, and logistics-over-the-shore (LOTS) facilities. It is important to note that nation assistance projects are also constructed in conjunction with many JCS-sponsored exercises.

Predeployment

Your unit has been notified that it will deploy to Honduras and has been given authority to coordinate directly with JTF-B. Your first point of contact at JTF-B is the J-3 Exercise officer, who will provide JTF-B points of contact and try to answer any initial questions you may have. He will suggest dates for your initial site survey and explain USSOUTHCOM and JTF-B requirements for theater and in-country clearances. Although you will probably know what project(s) your unit has

An engineer finishes placing window frames in a new school building in Macora, Honduras.

been assigned, you should also contact the DCSENG project officer for verification and status. The project officer can verify your equipment requirements.

Generally, units working on vertical projects will only require tool kits and generators for power tools. Vehicles for hauling troops, materials, and small pieces of construction equipment, such as concrete/mortar mixers and compactors, will be provided. On the other hand, units working on horizontal projects or projects requiring specialized equipment, such as well drilling and quarrying, will be expected to deploy with their equipment.

The initial site survey mentioned earlier is critical to the success of your deployment. It is the first opportunity for an on-the-ground reconnaissance. You will meet and be briefed by the JTF-B staff, visit project site(s), verify bills of materials (BOM), and begin coordinating the details of your deployment.

Ideally, you should schedule your survey 150-180 days before deployment and plan for three to five days on the ground. Team size is up to you, but is limited by transportation and security considerations and must be coordinated with, and approved by, JTF-B. Once dates have been determined, the J-3 Exercise officer will coordinate your visit with the JTF-B staff.

As soon as travel arrangements for your site survey have been confirmed, contact the J-3 Exercise officer who will coordinate for your arrival. Make sure to travel via Military Airlift Command (MAC) aircraft. You will fly directly to Soto Cano Air Base and be met by a member of the JTF-B staff. Travel via commercial airline should only be considered as a last resort, otherwise you may experience lengthy customs delays at the civilian airport in Tegucigalpa.

Once your site survey team has arrived at JTF-B and has a chance to settle in, you will meet the JTF-B staff and receive a series of briefings covering, among other subjects, JTF-B, the current threat, force protection, and preventive medicine. These briefings are important to safe training and will be required for every member of your unit immediately upon deployment. You should also call on the JTF-B commander to discuss your training objectives and gain an understanding of his philosophy on training in Honduras. Prior to your arrival, the JTF-B staff and subordinate elements will have completed their staff estimates, discussed your deployment, and will be prepared to discuss specific details with you.

For example, the J-2 and J-3 Force Protection staffs will have analyzed the threat and coordinated with the Joint Security Force (JSF) commander for the appropriate security requirements. Air and ground transportation will have been coordinated as well as billeting, if required, in an approved safehouse.

The J-5 will have made initial contact with local officials and discussed the "1/3 Rule" with them. The DCSENG project officer will have developed a detailed project folder that includes a bill of materials, maps, detailed directions to the site, points of contact, special equipment requirements, and any significant site considerations. He will also be prepared to discuss tool and equipment requirements unique to your project(s).

The J-4 will have discussed transportation requirements with your higher headquarters and will be prepared to provide details about customs clearance and ports of entry for both personnel and equipment. Finally, the ARFOR staff will have identified virtually all of your in-country logistics requirements.

While conducting the reconnaissance of your project site(s), you will be accompanied by the DCSENG project officer, a Spanish speaking J-5 representative, a JSF security element, and other required JTF-B personnel. At the project site you should discuss with local officials how Honduran civilian and military personnel will be incorporated into your work force. The regional military or police commander will provide jobsite security during your deployment, including movement to and from the project site(s). It is important that you discuss security requirements with the unit commander tasked to provide the security. The JSF security element accompanying your survey party will assist you in ensuring all requirements are addressed.

During the site survey you should also look carefully at proposed billeting and messing arrangements to ensure they meet your needs. When the location of project sites precludes units from being billeted at Soto Cano Air Base, other arrangements must be made. Due to security and health requirements, options are limited. While JCS exercise units generally live in temporary basecamps, that is usually not feasible for units working on nation assistance projects. These units can either stay at Honduran military installations or in approved hotels. Both offer advantages and disadvantages, but the decision will often be made solely on availability. One of the primary purposes of the site survey is for you to verify the scope of work and BOM. The best time to do that is during your project site reconnaissance.

Once you're satisfied with the scope of work and BOM, the DCSENG project officer will requisition materials and special equipment through the ARFOR S-4 and Contracting. Immediately after returning from your ground reconnaissance, take some time to think through everything you saw and heard. Ask questions about anything that's not clear.

Prior to departing Honduras you will participate in a final coordination meeting with the JTF-B staff and subordinate units. This is the time to review your visit, identify unsettled issues, and ensure you know who is responsible for resolving them. Your final task before departing should be to outbrief the JTF-B commander.

When time and funds permit, you should attempt to make a final coordination visit approximately 90 days prior to deployment. You will have had an opportunity to discuss your initial site survey with other members of your unit and

With the old school serving as a backdrop, an engineer smooths the concrete foundation for a new school in the Honduran village of El Corozo.

incorporate their comments into your training plan. This final visit will allow you to meet with the staff one last time and ensure all the details agreed to during your previous visit are being finalized to your satisfaction.

Deployment, Execution, Redeployment

Deploy your advance party one or two weeks before the main body. The advance party should have sufficient personnel to ensure preparations are made for the arrival of the main body. This can make the difference between exercise success or failure. Tasks will include receiving equipment and baggage shipped from home station, coordinating required briefings with the ARFOR S-3, and conducting any last minute coordination. Preparations will also include receiving materials and equipment and preparing billets for the main body at the project site(s) or at Soto Cano Air Base. Depending on ports of entry and location of project site(s), it may also include arranging for air transportation and/or ground convoys to move troops and equipment.

During your unit's deployment you will be expected to provide a liaison officer (LNO) (senior NCO or officer) who will represent you at Soto Cano Air Base. An engineer unit LNO is usually provided desk space in the DCSENG section. However, his or her primary staff responsibility is to the J-3 Exercise officer. The LNO is responsible for coordination with the JTF-B staff to ensure all your needs are met and all required reports are submitted accurately and on time. Each morning, Monday through Saturday, he will attend the JTF-B command and staff meeting where he will brief your project status. The LNO will be important to the success of your deployment and should be one of your best people.

Except for rare occasions, your main body must transit Soto Cano Air Base to inprocess before moving to your project site(s). This gives the JTF-B commander the opportunity to ensure all of your personnel receive the information they need for a safe deployment. Your soldiers will be welcomed by the JTF-B commander and receive briefings covering JTF-B, the current threat, force protection, reporting civil rights violations, and preventive medicine. Depending on the time of arrival and the location of project site(s), your soldiers could easily complete inprocessing, move to their billets, and be prepared to start work the day after they arrive.

Once you've arrived at your project site(s), project completion is up to you. JTF-B will provide a Spanish speaker if there are none available in your unit. You will also be provided a security team of one or two military policemen to assist you in ensuring the Honduran security element is providing adequate protection. During your deployment you will be visited by the DCSENG project officer and quality assurance NCO as well as other members of the JTF-B staff.

You will be required to maintain contact with the JTF-B command post 24 hours a day. Primary means of communications is secure tactical satellite (TACSAT) which the J-6 can provide. At the end of each day you will be required to account for all of your personnel and sensitive equipment and submit a report, called "Tubes Up," to the JTF-B command post.

Prior to redeployment you will meet with the JTF-B staff to review and finalize plans to complete your project(s), turn them over to the users, and redeploy your unit to home station. If you've followed my advice and assigned LNO duties to one of your best people, this meeting will merely be a review of completed actions. If not, there will be some work to do. Redeployment will include cleaning and turning in equipment, turning over billets, preparing unit and personnel property for customs check, and getting your personnel back to home station. Before leaving Honduras, get your soldiers together and conduct an after action review. Capture comments and use them to prepare your after action report and prepare for future training.

Summary

Construction training in Honduras can and should be a valuable training event for your unit and personally rewarding for your soldiers. Whether deploying for six months in support of exercise FUERTES CAMINOS, or for two weeks to execute nation assistance projects, your unit will improve its readiness, provide much needed help to the Honduran people, and contribute to stability in Central America. Joint Task Force-Bravo is available with the experience and expertise to help ensure your training objectives are met and all of your soldiers return home safely. The commander, staff, and subordinate elements are committed to your success.

Major Brubaker is S-3 of the 589th Engineer Battalion at Fort Leonard Wood. He previously served as assistant deputy chief of staff (engineer), JTF-B, Soto Cano Air Base, Honduras. Other assignments include senior team leader (instructor) for the Engineer Officer Advanced Course, Army Engineer School; division engineer (FWD), 2nd Armored Division (FWD); two tours as a company commander; construction officer, and platoon leader. He holds a bachelor's degree from the University of Maryland.

Engineer Solution

DEVELOP A SCHEME OF ENGINEER OPERATIONS

Step 1. Analyze relative combat power. This analysis of relative combat power is based on the situation template (Figure 1, page 24) and an engineer battlefield assessment of threat and friendly engineer capabilities.

- *Threat engineer capability.* No obstacle activity has been located from the line of departure (LD) to phase line (PL) Red. From PL Red to PL White, tactical obstacles in place are oriented to an armored force using the roads. All of the mines appear to be surface laid and under the observation of at least one LP/OP. These obstacles are in range of threat indirect fire assets.

  Protective obstacles on Obj Polk are extensive, but a clear picture of the objective can be created from intelligence gathered by your scout/sapper element. You plan for the sappers attached to the scouts to link up with Companies A, B, and C before the companies begin their assaults. The sappers will inform the company commanders about preselected breaching sites, and threat strengths and vulnerabilities. You work closely with the battalion S2 to ensure that the situation template is accurate and up-to-date.

- *Friendly mobility/survivability (M/S) capability.* For this problem, the assessment of friendly capability is based on the available mobility assets. TF Bayonet has your engineer platoon of 27 personnel. You have complete demolition boxes, satchel charges, bangalore torpedo kits, and bolt cutters. Each of the nine infantry platoons is capable of conducting limited breaching operations. Your sapper platoon has trained extensively with this battalion and can quickly integrate into the combined arms team.

Step 2. Identify missions and allocate forces. In this step, use the reverse planning process to identify engineer tasks, working from Obj Polk back to the line of departure. Each time an engineer mission is identified, allocate the force needed to accomplish it. This is an unconstrained allocation.

Lane North

1. Assist in a covert breach of obstacles while infiltrating the task force.
2. Clear the wire/mine obstacle on Sandt road, and mark the lane and position guides.

Lane South

1. Assist in a covert breach of obstacles while infiltrating the task force.
2. Breach one footpath through protective obstacles on Obj Polk for each dismounted platoon.
3. Assist in clearing bunkers and destroying BMDs, as required.
4. Clear anti-vehicular obstacles off Sandt Road, and mark lane(s) and position guides to pass TF Steel.

As you allocate resources, you realize there are not enough engineer assets to conduct all engineer mission support requirements. You bring this to the attention of the S3.

Engineer Solution

He requests additional assets from the brigade, but tells you to complete the task organization on the assumption that no additional assets will be received.

Step 3. Develop a scheme of engineer operations. The goal of this step is to integrate the following into the maneuver scheme of operations: force allocation, the execution of all engineer tasks identified in Step 2, and engineer priorities. The scheme of engineer operations is developed by working the maneuver plan from the line of departure, through the attack on Obj Polk, and to consolidation on the objective. When you "wargame" the maneuver plan, keep in mind that all engineer tasks must be accomplished with the assets available. Experiment with different resource allocations, keeping in mind the commander's intent, the priority of effort, and TF Bayonet's mission.

As assets become scarce, identify where mobility assets can reasonably be expected to complete several tasks. Do not forget mobility assets that are available in the maneuver force. Remember, you are the TF engineer, not just the platoon leader.

Possible Scheme Of Engineer Operations

Step 4. Balance force allocations with available assets. Infiltration lane South has priority. At the end of Phase 1, an engineer platoon is required at Obj Polk, and an engineer squad is required with Company A, on Sandt Road. The commander said that surprise and speed are critical to the covert breaches on Obj Polk, so the engineer effort at the objective is key.

Company A will conduct detailed breaching rehearsals with the sappers before crossing the LD. Then, with assistance from the sapper team, they will breach the obstacle on Sandt Road. Consider using some of the sappers that went with the scouts. Those sapper's hard intelligence about the obstacle could simplify this breach for Company A.

Two sapper demolition (demo) teams will work with Company C to clear bunkers and BMDs on the southern end of the objective. After the southern end is secured, the engineer effort will shift to passing Company B through Company C's breaches to continue the assault. The demo teams with Company C will shift to Company B's control to continue the assault on Obj Polk.

Two engineer squads will be required to breach the obstacles on Sandt Road at the objective. One squad probably could complete this task, but speed in breaching these two obstacles to allow the passage of TF Steel is critical. Both obstacles must be breached and marked at about the same time. Infantry platoons from Company C will assist in these breaches.

Step 5. Integrate your plan into the maneuver course of action sketch. Prepare a statement describing the scheme of engineer operations. Your statement must include:

- Task organization for the mission.
- Engineer mission priorities for each phase.
- How engineer assets will support the maneuver course of action.

Engineer Solution

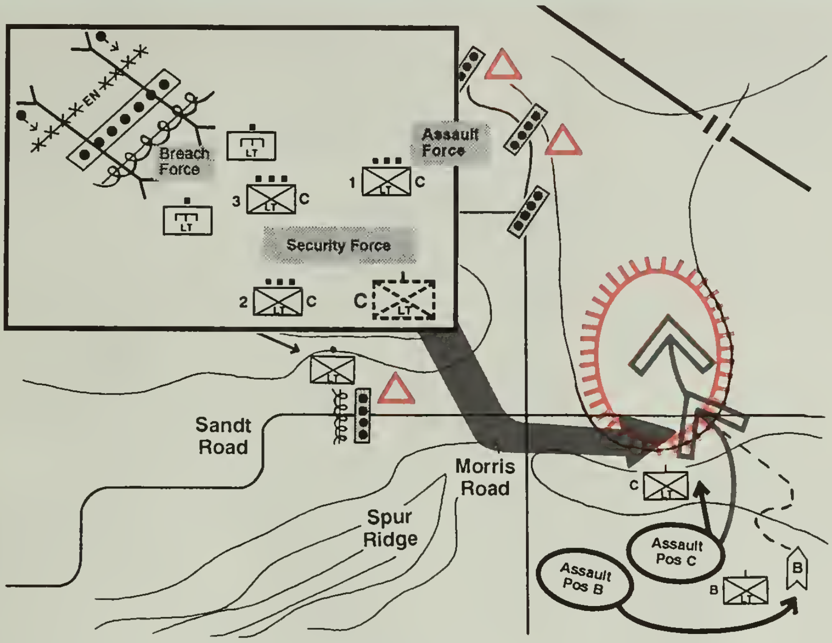


Figure 4

Wargame and refine the engineer plan. Visualize the execution of the operation, from Phase 1 through Phase 3, through the eyes of the commander. Pay particular attention to any shortfalls with your plan. Be knowledgeable about all other staff members' plans, and ensure they are mutually supporting. Remember, this must be a combined arms plan.

After the southern end of the objective is secured, Company B will be passing through to continue the assault. Securing the southern end of the objective (Figure 4) has two benefits. It will eliminate the overwatching fires on the obstacle located west of Obj Polk, and it will allow Company A to eliminate the LP/OP and breach that obstacle.

During the wargaming process, you identify a potential problem at the objective. After the southern end of Obj Polk is secured, your mission will shift to assisting Company B as it passes through Company C's breaches. Simultaneously, the demo teams must switch from Company C to Company B and continue the assault. Your other two sapper squads must breach the three anti-vehicular obstacles that block Sandt Road on Obj Polk, and pass TF Steel through to the east (Figure 5, page 46). To eliminate this potential problem, you decide to place yourself with Company C for the covert breach and to clear the obstacles on Sandt Road. Your presence will ensure the smooth transition of forces as they support this operation.

Recommend a course of action. According to the commander's intent, the speed of the breach is key. Thus, the mobility tasks required to get onto the objective and clear Sandt Road are the first priority. Because Company C must conduct a covert breach into Obj Polk and clear the southern end of the objective, you recommend attaching two engineer squads plus two teams from a third squad to Company C (Figure 6, page 46). Company B requires two demo teams, which will be picked up as Company B passes

Engineer Solution

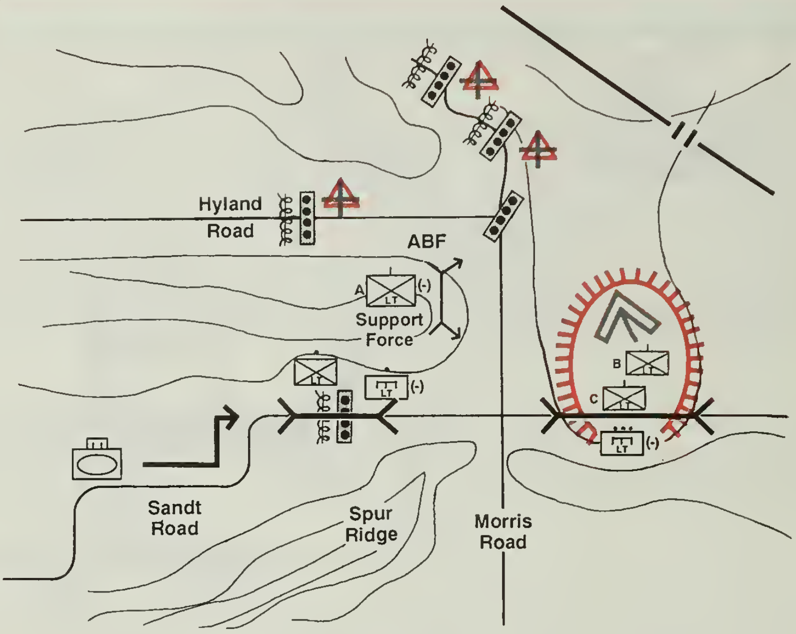


Figure 5

through Company C's breaches. Company A requires another squad to breach the obstacle on Sandt Road, but assets are not available. Therefore, a sapper team that worked with the scouts will link up with Company A and assist in the breach. If the sapper team fails to link up with Company A, previously developed and rehearsed contingency plans will be implemented.

You will locate with Company C during the covert breach operation. By doing this, you can ensure the demo teams' transition is completed as planned, the vehicle lanes on Sandt Road are cleared and marked, and that guides are in position to pass TF Steel through to their objective.

Task Organization

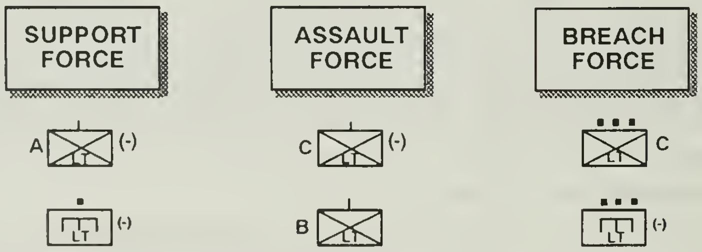


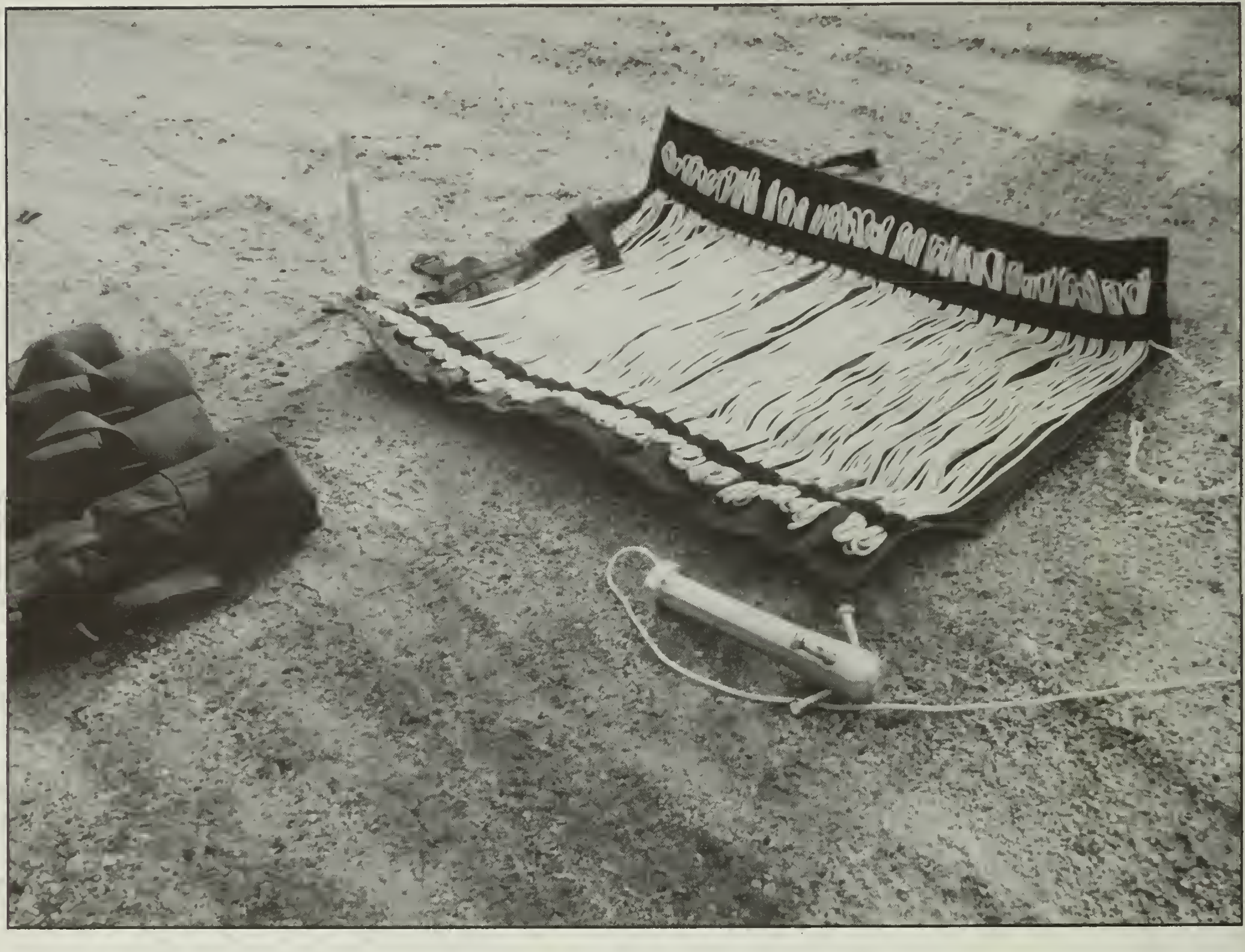
Figure 6

This Engineer Problem/Solution was submitted by Captain Scott Lind, a writer/instructor in the Department of Instruction at the Engineer School. He has previously served as an observer controller at the Joint Readiness Training Center, assistant division engineer, 6th I. D, (L) Alaska, and commander of A Company, 6th Engineer Battalion.

The Bullet Trap:

Hastening the In-Stride Breach

By Captain Stephen R. Hesler
and
Captain Ronald N. Light



The bullet trap set, as tested at the National Training Center (NTC) and Fort Benning. Used by combat engineers in force-on-force exercises, the bullet trap proved easy to use and effective in clearing trip wires.

Clearing trip wires complicates the already difficult and dangerous job of clearing minefields and other obstacles. The Belvoir Research, Development and Engineering Center (BRDEC), and Fort Benning's 72nd Engineer Company have come up with an equipment proposal to make the job faster and easier.

In April 1989, Frank Tucker, a civilian engineer at BRDEC, trained with the 72nd Engineers at the National Training Center (NTC) at Fort Irwin. His trip to the NTC was part of the Design Engineers Field Experience With Soldiers (DEFEWS) program. During his visit, Tucker recognized that the current method of clearing obstacles of booby trap wires was slow and dangerous.

The current method of using grapnel hooks to clear trip wires is extremely slow. It takes an experienced engineer four to five throws to clear a 100-meter minefield of trip wires. The in-stride breach, probably the most challenging and difficult combined arms task, must be executed rapidly.

Unfortunately, using a grapnel hook to clear trip wires nearly doubles the amount of time needed to conduct an in-stride breach. In addition, even with rigorous training, the cord attached to the grapnel hook routinely tangles, exposing the sapper team to additional enemy fire.

In the quest for a "better mouse trap" for trip wires, we contacted Dr. David Stefanye, a senior

> **"...The bullet trap takes the combat engineer one step closer to being able to match the momentum of modern mechanized warfare."**

scientist at BRDEC. Stefanye suggested using a bullet trap to propel the grapnel out into obstacle areas.

Commercial bullet traps are hollow metal cylinders about a foot long which slip over the muzzle of a weapon. True to their name, they "trap" a live round as it leaves the rifle bore, and are propelled forward by the force of the round.

While the idea seemed to be workable, a couple of problems had to be solved. We recognized that using live rounds with a bullet trap would be impractical for training scenarios. First, they might pose a safety hazard to opposing forces during field exercises. Secondly, they had to be reusable (commercially available bullet traps are useless after one firing).

With the assistance of Steve Bennett, a design engineer at BRDEC, blank rounds provided a tentative solution. But tests with standard Army blanks showed they were not powerful enough to project the trap more than a few meters. However, a special high-powered blank manufactured by an Israeli company produced enough force to propel a 300-gram bullet trap more than 250 meters. After Bennett redesigned the trap to maximize its reusability and wire-catching capability, BRDEC again contacted the 72nd Engineers. The company was asked to give the device a field test, and provide soldier comments on its usefulness.

In January 1990, DEFEWS participants David Nelson and Mike Stumbaugh accompanied the 72nd in field exercises at Fort Benning. In force-on-force exercises, the 72nd Engineers, Nelson, and Stumbaugh all found the device to be a success.

Using the bullet trap to clear wire obstacles cut an engineer's exposure time by about 90 percent. They also found that the bullet trap could be fired "buttoned up" inside a tracked vehicle. This protected soldiers from enemy shrapnel, small arms, and chemical agents.

A more extensive test of the bullet trap came when the 72nd deployed with the 197th Infantry Brigade to the NTC in February 1990. Mike Pocratsky, another DEFEWS participant, accompanied the unit. He brought with him four sets of the device, each consisting of a machined aluminum bullet trap and a pack tray, which holds the attached nylon line.

During force-on-force and live fire exercises, the 72nd Engineers successfully employed the new bullet trap. The trap proved to be a fast, safe, and reliable way of clearing obstacles of trip wires.

The device is simple to use and inexpensive to produce. In addition, its use is not limited to engineers. Mechanized infantry and other combat units could use the bullet trap with equal success.

As a tool for conducting the in-stride breach, the bullet trap takes the combat engineer one step closer to being able to match the momentum of modern mechanized warfare.

The bullet trap is currently undergoing further study by BRDEC and the Engineer School's Directorate of Combat Developments.

Captain Hesler is attending graduate school at Loyola University. An infantry officer, he previously served as a research and development coordinator at BRDEC, Fort Belvoir. He also served as a company commander and staff officer with the 194th Armored Brigade, and as a platoon leader with the 1st Armored Division. He is a graduate of the Infantry Officers Advanced Course.

Captain Light is attending graduate school at the University of Virginia. He previously served as commander of the 72nd Engineer Company, 197th Infantry Brigade, and as a company commander for the 43rd Engineer Battalion. Other assignments include battalion S-4, battalion maintenance officer, and platoon leader. He is a graduate of the Engineer Officers Advanced Course, and holds a bachelor's degree in environmental sciences and technical writing from Pennsylvania State University.

A Schoolhouse for Xepon

By First Lieutenant Walter P. Cole

For engineers, nation assistance missions provide challenges that are unique to each country. Climate, the quality and availability of materials and equipment, and even the current political situation are all factors which can wreak havoc with even the most carefully planned construction schedule.

When the Laotian government asked the United States for assistance in building rural schoolhouses, the 84th Engineer Battalion, Schofield Barracks, Hawaii, took up those challenges.

From December 1990 to May 1991, soldiers of the battalion were in Laos to conduct site surveys of three possible school locations in Xepon, Xam Neua, and Muang Nong. This article covers the construction of a school in late 1991 at Xepon, Laos, about five miles from Vietnam.

Site Conditions

Access to Xepon was by a five and one-half hour ride over 130 miles of difficult roads. Air service to the site was not available. Entry to the school building site was made by constructing a one-half mile road (combat trail) from the main route. Transporting materials up this trail, especially under muddy conditions, later proved to be very difficult.

The school site was covered with dense foliage and undergrowth which required clearing. Additionally, the site was suspected to contain unexploded ordnance from the Vietnam War. The site location provided easy access to construction water from the nearby Mekong River.

School Design

The design for the five-room, enclosed school (see diagram, page 52) had to consider the local availability of materials, and limited manpower, time and equipment. Fairly simple construction techniques were also required. No electrical fixtures or mechanical devices were requested. The final design included the following features:

- Concrete slab on grade
- CIP-reinforced concrete columns
- CMU block exterior and interior walls
- Wooden trusses
- Corrugated metal roofing
- Wooden doors and louvered windows

The structure was single story and offered 2,500 square feet (100' by 25') of usable space. The five classrooms were divided by interior masonry walls. Based on this design, and experience from a previous team deployment in the country, the bill of materials (BOM) was easily estimated and validated. Planning factors for construction outlined in TM 5-333 were used to establish a 45-day construction period.

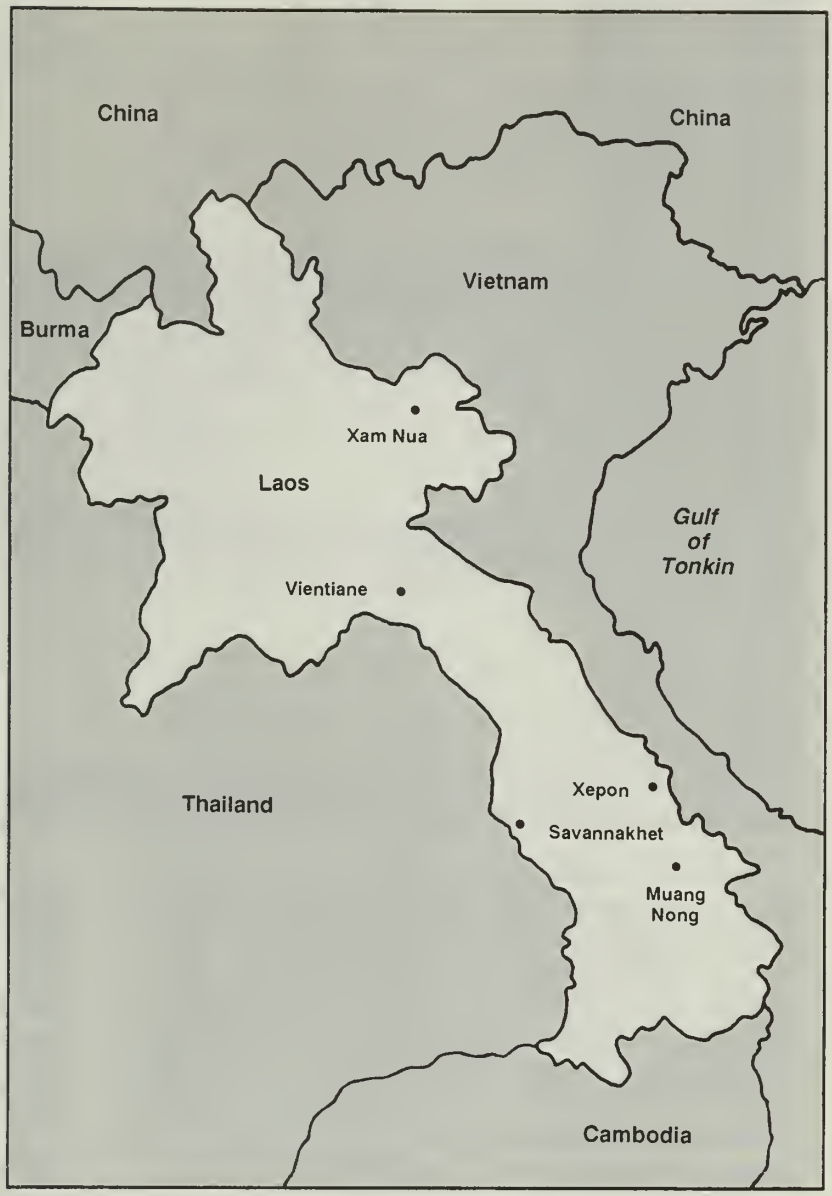
Mission Preparation

The most critical part of mission preparation was selection of the construction team. Soldiers from Charlie Company were selected for the mission, based on their proven construction skills and recent experience with similar construction on the Hawaiian island of Oahu.

Team size was limited by the Laotian government to the minimum number of soldiers necessary to complete the schoolhouse within the scheduled time frame. The final team consisted of 12 soldiers, including a platoon leader, platoon sergeant, carpenters and masons, two communications specialists, and a Special Forces medic.

The communications specialists were responsible for maintaining round-the-clock contact with the American embassy in Vientiane. They also provided a back-up communications link with battalion headquarters in Hawaii. The Special Forces medic, with his advanced medical training, was necessitated by the total lack of medical support at Xepon.

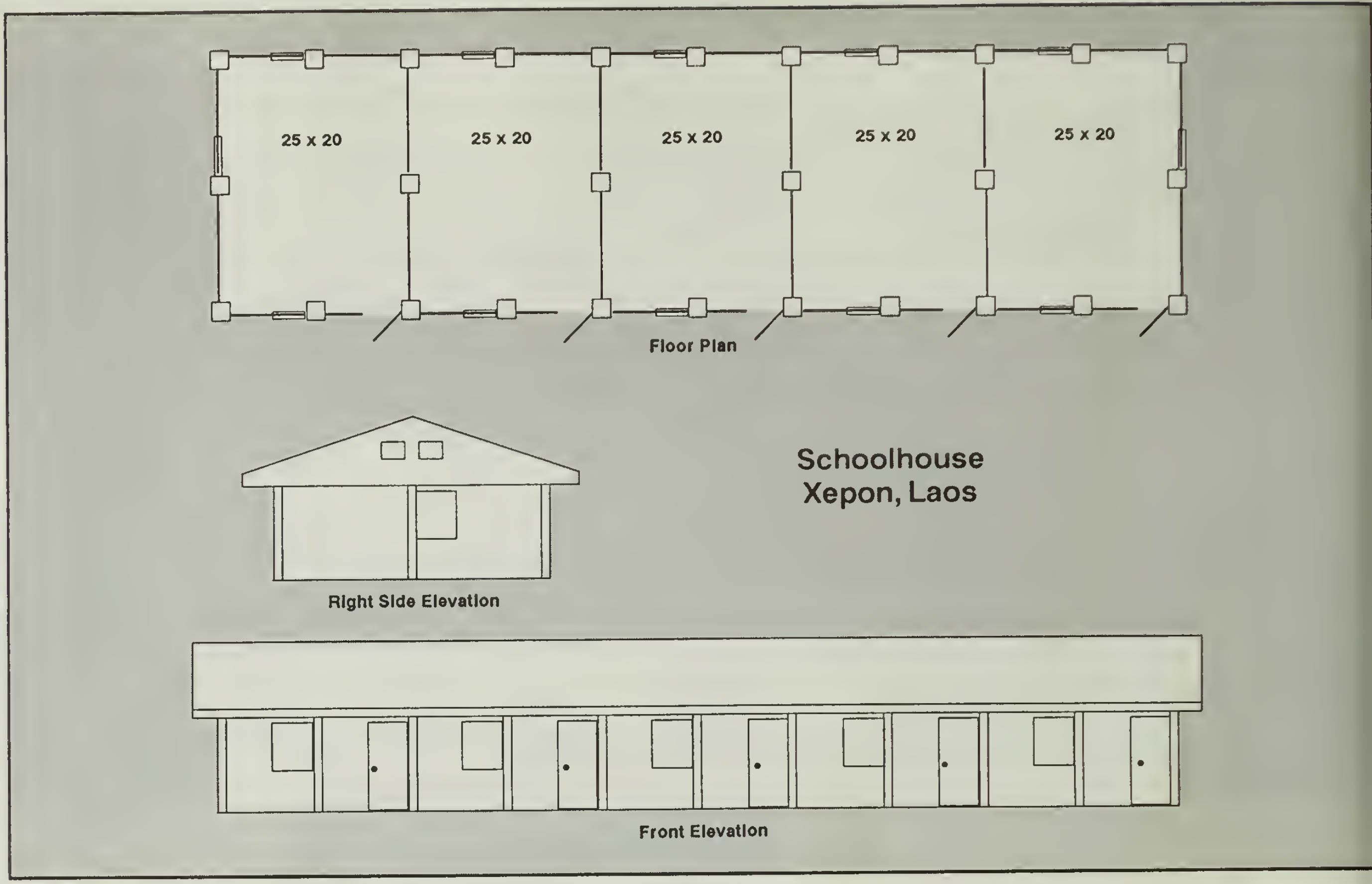
Other preparations included renting two 9-cubic-foot concrete mixers to be shipped along with the team's tool kits. Such mixers were not available in Laos, and a mobile, light-weight mixer was not on the unit' s TO&E (tables of organization and equipment).



Execution

The advance party left from Hawaii on September 14, 1991. Their tasks included:

- Locating and purchasing all construction materials (except for louvered windows, which came from Hawaii).
- Coordinating transportation of all materials to the site and staging the materials.
- Coordinating and validating the clearing and grubbing of the site.
- Surveying the site for unexploded ordnance, with the assistance of the 6th Explosive Ordnance Detachment from Hawaii.
- Coordinating the movement of the main body and supplies into Laos.
- Establishing the base camp.



From the outset, the project's planned schedule had to be changed. Previously coordinated transportation for the advance party fell through, which directly affected the party's ability to locate and procure materials. Fortunately, a hotel owner in the region assisted the team with their transportation needs—saving the project from serious delay. Additional time delays were experienced in locating a bulldozer and letting a contract for its use in site clearing. Some difficulty was also experienced in finalizing the size of an accompanying Laotian security force, and settling their payment requirements.

But these challenges were minor compared to the team's discovery that the central government had placed a ban on timber cutting. Since lumber of the sizes and quantities necessary for the project were not in stock at lumber yards, the ban threatened the entire project. Fortunately, the Laotian liaison assigned to the team worked with the mayor of Savannakhet to have the ban temporarily lifted for the project. All of these events caused a one-week delay in the start of construction.

As soon as the main body and the construction materials arrived in Xepon, the remnants of a typhoon dumped heavy rain on the area for five straight days. Because of the site's remote location, with tents providing the only shelter, the use of power tools was halted during these rains. The construction schedule had to be revised once again.

To make the best of the difficult circumstances, the team concentrated on preparing the pad and footers. This was made significantly easier by the amount of water that had soaked into the ground. During the Laotian dry season, the required earthwork would have required many hours of hard labor. With approximately 300 linear feet of footers to dig for the pad, this would have taken considerable time and effort.

In addition to making it easier to dig, the unwelcome rain provided another unexpected benefit. The site didn't have its own water source for construction of concrete placements and other construction needs. The team had a water truck, but it was empty after two concrete placements of about 10 cubic yards each. The heavy rains made the access trail impassable for the truck, and it was unable to reach the river to get more water. But rain had collected in the footing excavations. Using an electric water pump, the team collected this water for construction use over several days—until the truck could be refilled at the river.

The early bout of poor weather forced the team to rethink all phases of the construction schedule to accommodate the possibility of more inclement weather. One such change was to complete all perimeter walls before beginning the interior walls. This allowed the roofing system to be completed as quickly as possible. Then, if more heavy rain or wind occurred, inside work on the building could be tackled under cover.

While constructing the walls, the team came across the first of several material obstacles. The concrete blocks used for the school walls presented several challenges. The blocks in Laos are of relatively poor quality, and selection is limited. In Savannakhet, only 3-inch-thick blocks were available. These blocks tended to be brittle and dimensions varied by as much as a one-half inch from block to block. Additionally, the height of these blocks was only 7 1/4 inches—three-eighths of an inch shorter than originally expected. As a result, the dimensions of the windows and doors of the school had to be changed. Field design changes were also made in wall height and to the tie-in of the walls with the roofing system.

Other problems were encountered with metal roofing and with plywood. The roof of the school was designed for 20 gauge corrugated metal, but the only roofing available in Laos was much thinner. So thin, in fact, that it could not support a person's weight, and dented easily when nailed to the wooden trusses. Extreme care was required to avoid such denting. It was also important to sequence roof construction to avoid any load on installed roofing panels.

The thickness of available plywood also caused problems. In Savannakhet, the thickest plywood available was one-eighth inch. Because of its susceptibility to warping, this plywood was too thin to be used in the ceiling. As a result, the team had to special order three-eighths inch plywood from Vientiane.

While these difficulties caused project delays, overcoming them with locally available solutions provided all members of the team with valuable experience in dealing with unexpected site problems.

Observations

The team used very little equipment to construct the school. Major items included two concrete mixers, two 3kwh (kilowatts per hour) generators, an electric water pump, and various hand power tools.

A significant challenge was placing more than 60 cubic yards of concrete with only two small mixers and ten men. In the hot climate of Laos, concrete sets quickly, requiring a fast placement rate. Both mixers were operated simultaneously to maintain an adequate rate. This taxed the stamina of the soldiers, who had to repeatedly lift 110-pound bags of cement to keep the mixers charged. This operation required the use of the entire team, yet daily concrete placement never exceeded 15 cubic yards.

With limited equipment and repair parts, maintenance was critical. Loss of any equipment could have caused failure of the entire mission. Round-the-clock maintenance on all equipment was required to ensure continued operations.

Complicating the maintenance problem was the poor quality of fuel in Laos. The low-grade fuel caused fouling of the spark plugs and fuel delivery systems. Constant cleaning of engine systems was required to overcome the problem.

The small team was hit hard by personnel losses during the deployment. One soldier was lost due to an emergency leave, one was medically evacuated to Thailand because of illness, and three others contracted Dengue Fever. However, redoubled efforts on the part of the remaining engineers pulled the mission through.

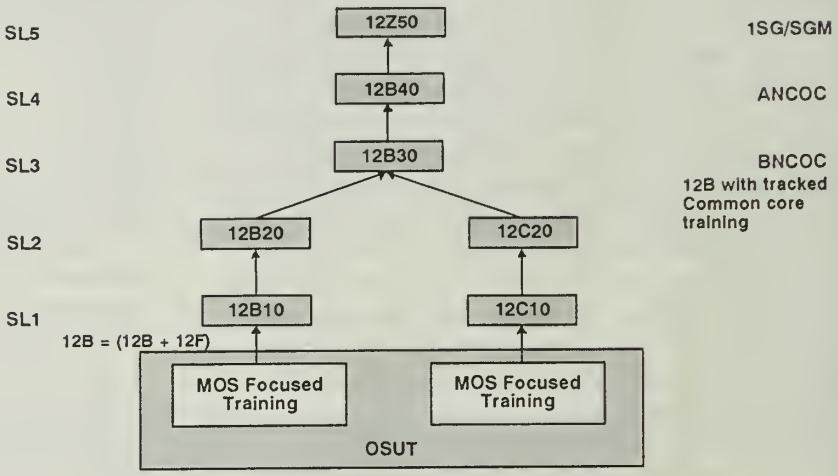
(Continued on page 61)

The new schoolhouse in Xepon, Laos. Despite many difficulties with materials and the weather, the project was completed on time.

MOS Consolidation:

Its Time Has Come!

CMF12 Consolidation



The consolidation of Career Management Field (CMF) 12 for combat engineers continues to be a major thrust in the Engineer School. Military occupation specialties (MOS) 12B, 12C, and 12F will consolidate into MOS 12B (Combat Engineer) beginning in the 3rd quarter of fiscal year 1994. This article supplements and updates information presented in previous issues of *ENGINEER* (April 1991 and February 1992).

The final concept approved by MG Christman on February 11, 1992 will reduce the number of MOSs, improve upward mobility for soldiers in grades E-6 and E-7, and provide consistent promotion opportunities for all CMF 12 soldiers. Beginning in the 3rd quarter of FY 94—

- MOS 12B and 12F will become 12B at the initial entry level and will continue as 12B through all skill levels of CMF 12 (see figure).
- MOS 12C will track separately from the initial entry level through skill level 20. It will merge into 12B at skill level 30.
- MOS 12B will consist of all CMF 12 MOSs from skill level 30 through skill level 40.

Several time-consuming actions must occur before the consolidation can take effect. The Deputy Chief of Staff for Personnel Integration (DCSPI) (formerly the U.S. Army Personnel Integration Center, USAPIC), is the coordinating agency responsible for officially effecting and documenting changes to CMFs. The DCSPI process adheres to Military Occupation Classification windows and takes about 18 months to complete. During this process the DCSPI notifies the United States Recruiting Command (USAREC), who then implement a program to revise contracts, advertisements, and marketing used to recruit new soldiers. Concurrently, course design and development efforts at the Engineer Center and the publication of Soldier Training Publications require almost a year to complete.

A plan is in place to ensure CMF 12 soldiers receive proper resident training:

- The 12B10 (12B and 12F) soldiers will receive One Station Unit Training (OSUT) that is similar to current 12B training. The new course will provide additional training in vehicle operations, with emphasis on vehicles normally found in mechanized combat engineer units.
- The 12C10 soldiers will track separately and receive OSUT training similar to their current program.
- At the 12B30 level, the Basic NCO Course (BNCOC) will include Common Leader Training, technical skill levels 1 and 2 refresher training, and skill level 3 training. The addition of refresher training on tasks NCOs were not responsible for before 12B, 12F and 12C merged is the major change. The 12B30 BNCOC students will receive skill level 30 training on all bridging and combat engineering tasks taught in the resident course.
- The CMF 12 Advanced Course (ANCOC) will remain as it is today.

Because all MOSs merge at skill level 30, BNCOC training will be critical. To receive accreditation, the eight satellite BNCOC institutions must provide training in all subject areas identified in the program of instruction, without exception. Accreditation is the critical gate for this action.

The consolidation of CMF 12 will improve upward mobility for our engineer soldiers. Smart and efficient training will be critical to the success of the consolidation and to the on-going success of our soldiers and units. Engineer leaders must work together to make this happen.

Captain Price is chief of the Course Development Branch, DOTD, at the Engineer School. He previously served with the 16th Engineer Battalion and the 20th Engineer Brigade.

By Captain James A. Price

Engineers Aid War on Drugs

By Sergeant Galen R. Putnam

Armed with dozers, graders and dump trucks, soldiers from the 39th Engineer Battalion (Combat) at Fort Devens recently played a vital role as part of the Department of Defense's (DOD) contribution to the President's National Drug Control strategy.

From July to October of 1991, the battalion's Alpha, Charlie and Headquarters Companies deployed to Arizona to build and upgrade border roads, and construct support facilities—such as helipads and training ranges—as part of Operation Borderline.

The large-scale operation, which falls under the auspices of Joint Task Force Six (JTF-6) (see accompanying article, inset), has provided a badly needed service to law enforcement agencies in the region.

"The work that the 39th has done for us has been an absolute blessing," said Theo Hudson, intelligence officer for the Border Patrol's Tucson Sector. "The Border Patrol simply didn't have the funding, equipment or expertise to build the roads or facilities that the engineers have provided. To put it simply, the Army has changed the face of drug smuggling in these parts."

At first glance it may not seem like it, but the key to interdicting drug smugglers and illegal aliens crossing the Mexico-Arizona border is a dusty road which has been carved out of the desert by the 39th. To the untrained eye, it's a simple dirt road; but it is a vast improvement over the rugged trail that formerly meandered along the rusted, three-strand barbed wire fence—often gaping with holes—which marks the international border.

The Border Patrol not only uses the now-negotiable road to patrol the expansive border with ease, but also to gather information on who or what has crossed the border.

"The border road is terribly important. It is the fundamental

For the 39th Engineers, the roadbuilding enemy was either choking dust or, as here, knee-deep mud. (Photo courtesy U.S. Border Patrol)

Charlie Company First Sergeant George J. Ruo ground-guides a 5-ton truck during culvert construction. (Photo by Galen Putnam)

element in our intelligence-gathering effort. Everything else is based on that," said Hudson. The road tells us how much traffic is crossing and where. It's our number-one intelligence-gathering tool."

The road is dragged daily, much like a baseball diamond, in order to keep it smooth. When the Border Patrol detects vehicle tracks or footprints crossing the road, they not only learn where border crossings are taking place, they can estimate who crossed and when.

The idea is simple but effective, according to Hudson. "First of all, since we know when the road was last dragged, we can approximate when the crossing took place. When we examine the footprints, we can get a good idea of who crossed. For example, if a large number of people crossed and there are children's footprints, in most cases that will be a group of illegal aliens coming across the border. If there are only one or two sets of prints and they appear to be men's—but the steps are very short—that might indicate someone carrying a heavy load. That's how a lot of drugs are smuggled across the border. People simply carry as much across as they can."

By examining the footprints, the Border Patrol can estimate how many pounds of narcotics may have been carried across the border by multiplying an average-size load of 40 pounds by the number of suspect tracks found. Most importantly, however, freshly-made tracks can lead agents to those who have crossed illegally.

Through trial and error and sheer persistence, smugglers continue to search for ways to foil the Border Patrol, even going so far as to strap carpet or foam rubber to their shoes to conceal their tracks. Thanks to the new border roads, such tactics will become increasingly unproductive for smugglers. "They've got a lot of tricks up their sleeves," said Hudson. "But the improved road surface really gives us the upper hand."

Hudson points out that although the Border Patrol possesses an array of high-tech detection equipment—including motion sensors and night-vision goggles—the road is still the most important tool they have. "That's an awful long border. We can't just place agents or detection equipment along the border at random," he said. "If we did that, we would spend 90 percent of our time chasing deer. By being able to determine where crossings are taking place, we best know where to place our resources."

Although it may seem to be easier to simply erect a solid barrier along the border, that can't be done for a number of reasons. "There is no way to keep people out," explained Hudson. "We don't have the money to build or maintain a Berlin Wall-type of structure along the border. Nor do we have the manpower to adequately man that type of structure. The border is just too long. We also have to take international relations into consideration. The border is a very sensitive issue."

With a wall out of the question, the Border Patrol is pleased with the additional interdiction capabilities the new road offers. "The

Army is doing an outstanding job, so good in fact, that I predict a 60 to 70 percent reduction in drugs coming across the border in the areas where the engineers have put in the new road," said Hudson.

While the border roads will be a boon to the Border Patrol, the other projects that the 39th worked on will be just as valuable. One of these projects is the recently completed Federal Law Enforcement Training Center range, built by the battalion's Headquarters Company in Marana, Arizona, near Phoenix. The range, which will be used by various law enforcement agencies, features a 30-point pistol range with 50, 25, 15, 7, and 3-yard firing lines—all with overhead cover. There is also a 360-degree, turn-and-shoot, combat-style range. A large support building was also provided.

In preparing the range, the company hauled, placed, and compacted more than 20,000 cubic yards of material. In all, that comes to approximately 2,850 dump truck loads of dirt. They finished the job in 30 days.

The importance of the mission which his soldiers performed wasn't lost on Lieutenant Colonel Kurt L. Kratz, commander of the 39th. "This isn't like an FTX or going to the NTC: you don't just leave and then assess how you've done afterwards," he said. "Here, we have actual customers who expected the Army to leave them with something they need."

While the emphasis was to provide support to others, the 39th reaped benefits as well. "We could have stayed in a hotel, rented our equipment, and worn yellow hard hats, but the Army and the taxpayers spend a lot of money to make sure that we can do our job under fire—with Kevlar on our heads." said Kratz. "You can't hire a contractor when bullets are flying. That's why we did it this way. This is the best possible training for an engineer battalion."

Alpha Company soldiers mark where they will place drainage tubes in a gulley. The large poles will support the tubes, forming a giant culvert. (Photo by Galen Putnam)

They are indeed training in a realistic environment—the only things missing are the flying bullets. "Home" consists of a small compound of camouflage-covered tents ringed with barbed wire. The "doorman" wears, not a tux, but full battle gear—and guests aren't welcome. At least the mess tent serves hot meals...sometimes.

The desert projects have also provided opportunities for many of the battalion's soldiers to try different skills.

"Since we don't have a great number of heavy equipment operators, we've cross trained many of our 12Bs. It's exciting for the guys to work on the heavy equipment," said Kratz. "Now they can step in and fill another important role if needed. That gives me tremendous flexibility as a commander and gives them a precious skill which is needed in the battalion."

Although the deployment has been challenging at times, Kratz

Soldiers from the 39th reinforce a dirt road after heavy rains damaged it. (Photo courtesy U.S. Border Patrol)

maintains that despite the hardships, it has been extremely worthwhile.

"This has been a tremendous learning experience," he said. "We took on a big mission and now I've got a lot of soldiers, NCOs and officers who will be leading battalions someday who have now seen that you can take something as big as this—and do it right! Something like this really makes you feel proud. Not only do we get great training, but we know that we are leaving something tangible behind."

Headquarters Company

Having perhaps the most diverse mission of the battalion's companies in Operation Borderline, Headquarters and Headquarters Company went from one extreme to the other, both in climate and projects.

Beginning in the mid-Arizona desert basin at Marana, the company encountered 115 to 120-degree Fahrenheit temperatures which forced them to work the "graveyard shift" while building the firing range.

"The elements presented a challenge, but the guys really pulled together and did a great job," said Captain Mark Morin, the company commander. "Of course, safety was a major concern because of the elements, but thanks to our NCOs, we've had an outstanding safety record."

After completing the range, the unit packed up and left the desert floor, heading 150 miles southeast—and 5,000 feet up—into the mountains near Naco, Arizona. There, the mission changed from vertical construction to road-building.

Said Morin, "The company adjusted well. Really, it's just like taking a hammer and pounding in an eight-penny nail, then switching to a ten-penny nail. The hammer is adaptable to both jobs."

While building 6.2 miles of border road near Naco was the crux of the company's job in the mountains, it was also tasked to fabricate 24 cement abutments for cattle guards, erect 300 feet of fence at the Naco Border Patrol Station, and wire and install a lighting system at the Douglas, Arizona, Border Patrol Station.

"The soldiers have done an outstanding job," said First Lieutenant Mark Guevara, company executive officer. "They are very proud of the job they did, because they know it's a real-life mission. They know that the contribution they made will help save lives and stem the flow of drugs into the United States."

Despite the work load, the spirits of the soldiers remained high. Said Specialist Darrel J. Freund, a heavy equipment operator, "The guys have done an excellent job, as good or better than any civilian contractor can do."

Alpha

During the project, Alpha company had been bivouacked on the outskirts of Nogales, Arizona, about a one-hour drive southwest of Fort Huachuca. The company's mission: build two roads and a weapons training facility.

The roads—one a border "drag" road, the other an access road to the training facility—totaled more than nine miles. Along the way, the engineers had to install 19 culverts, five fords, and seven cattle guards.

The training facility, which will be used by the U.S. Customs Service and regional law enforcement agencies, consists of a 100-meter rifle range with overhead cover, three 50-meter pistol ranges with overhead cover, and a support building with classrooms and latrines.

"Things went very well and everybody had adapted well to the field," said First Lieutenant Allen Brannan, company executive officer. "...what we did is such a shot in the arm for the law-enforcement agencies who are fighting the war against drugs, the soldiers really dug in and did a great job. They put aside the hardships and concentrated on doing the best job they could. They really took pride in what they were doing."

That pride is particularly evident in the 90 percent equipment on-line rate, achieved despite the constant punishment the desert work inflicts. On top of that, they did it at their own on-site, makeshift motor pool—without engineer support from Fort Huachuca.

"You can't get the job done if you don't have the equipment to do it," said Brannan. "The maintenance guys have really done a great job. They've really kept us ahead of the game."

When it comes to building roads, however, getting the equipment into operational condition is only the beginning. It takes qualified heavy equipment operators to get the mammoth graders, rollers, dump trucks and other vehicles into the field to get the job done. Since the 39th is a combat engineer battalion, one asset they lack is a surplus of heavy equipment operators—a problem they solved through cross training.

"We did a lot of cross training," said Brannan. "We got a number of our combat engineers trained and working on heavy equipment, which is something they rarely, if ever, get a chance to do. It was a good learning experience for everybody."

Charlie

In contrast to the hilly, almost lush terrain near Nogales, where Alpha Company worked, Charlie Company found itself working along a long, straight, dusty, and lifeless stretch of border road. Besides fellow soldiers and equipment, the only other things around for miles were scrub brush, a few birds, and an occasional whirlwind.

The engineers of Charlie Company began their mission near Douglas, Arizona, about an hour-and-a-half drive southeast of Fort Huachuca. Their task was to upgrade 27 miles of border road, heading west from Douglas toward Naco. Along that stretch, they installed 18 cattle guards, 10 culverts, and eight fords. The unit was also tasked to construct a 60-by-60 foot concrete helicopter pad with marking lights and windsock, a grounding rod tiedown system, and a 150-foot sidewalk for the Border Patrol.

Challenges included rains that washed out portions of newly completed road. "We were flexible from the start, so the rains really didn't set us back at all," said company commander Captain Tom Anhut. "We turned it into a

A Border Patrol vehicle smooths a border road. The next morning, footprints across the smooth dirt will indicate a likely illegal crossing. (Photo courtesy U.S. Border Patrol) learning experience so, in a way, it was actually beneficial."

After completing the work near Douglas, Charlie packed up and relocated to Naco, where they started work on another stretch of border road. Here, the mission was to head west to meet Headquarters Company, which was upgrading the road in an easterly direction from their location in Palominas.

"This was a great training opportunity for the company," said Anhut. "Being 2,500 miles from home in the field for two-and-a-half months gave us an unparalleled chance to evaluate our young leaders and for them to show what they can do."

Despite the grueling work and the length of the deployment, many of Charlie's soldiers remained upbeat, and said they were glad to make a contribution to the war against drugs.

On a job site during the deployment, Corporal James Conley, an engineer mechanic, perhaps summed up the Operation Borderline for the soldiers of the 39th: "Being down here is for a good purpose, a good cause. Even though this is keeping me away from my family, it's worth it to me because I'm so much against drugs. Most of the guys here feel the same way—especially guys with kids. We don't want our kids to be exposed to drugs, and this is just one way that we can help make sure that it won't happen."

Sergeant Putnam is a photojournalist assigned to the U.S. Army Intelligence School, and is stationed at Fort Devens. He is a graduate of the Department of Defense Information School's photojournalist and editor courses.

Sergeant Putnam's article is reprinted with permission from the Fort Devens post newspaper, The Dispatch.

JTF-6 and the War on Drugs

By Colonel George A. Woodbury

Joint Task Force Six (JTF-6) was established in November 1989 at the direction of the Secretary of Defense. Its mission is to employ forces and conduct training in support of federal, state, and local law enforcement agencies throughout the Southwest border region in order to help counter the flow of illegal drugs into the United States.

That mission is no small undertaking. The Task Force's area of operations includes the four border states of Texas, New Mexico, Arizona, and California—a land area of more than 600,000 square miles.

JTF-6 is headquartered at Fort Bliss, Texas, and is under the control of an Army brigadier general. The headquarters staff is responsible for the planning and coordination of all military support requested by law enforcement agencies. If operational support is appropriate, the task force identifies the unit which will provide the support, ensures the unit is operationally ready to deliver the support, and exercises control of the unit conducting the mission.

During its first year of operation, JTF-6 planned and coordinated more than 200 requests for support from 30 different federal, state, and local law enforcement agencies. To date, that figure has grown to more than 525, in support of more than 180 different law enforcement agencies.

Support provided to law enforcement agencies included engineer construction and repair, ground reconnaissance and surveillance, terrain denial, transportation, sensor and signal interception, the training of law enforcement officers in military related skills, and the loan of military equipment and personnel.

Engineer support to drug law enforcement agencies presents some unique challenges. In addition to providing coordination between the requesting agency and Army units, the JTF-6 staff engineer must also ensure that the Army meets all provisions of the various environmental laws. These include the National Environmental Protection Act, the National Historic Preservation Act, the various Threatened and Endangered Species Acts, the Native American Graves Protection and Repatriation Act, the Native American Religious Freedom Act, and AR 200-2.

Compliance with these laws is coordinated through the four Army Corps of Engineer Districts that cover the border states. In addition, rights of entry must be obtained from all affected landowners, memorandums of agreement developed for state and public land access, and applications made for Section 404 (Clean Water Act) permits.

Finally, the requesting agency must pay for materials required for the mission. The engineer staff assists them with developing a bill of materials, contracting, and in some cases, even locating funding.

The assistance process begins with a support request forwarded from the requesting drug law enforcement agency to Operation Alliance. Alliance, collocated with JTF-6, is a coordinating agency manned by representatives of the various federal, state, and local drug law enforcement agencies.

Operation Alliance reviews the request and forwards it to JTF-6. The staff engineer receives the request and coordinates a site visit for an initial assessment. These engineering assessments are frequently farmed out to units possessing the required capability (horizontal or vertical), or to Engineer Officer Advanced Course students during their seventh and eighth weeks of training.

Once completed, these estimates provide the planning details needed by JTF-6 to determine if the work can be performed by military engineer units. Before a mission can be accepted for execution, it must provide mission essential task list training for the unit, provide a benefit to the nation's counter-drug effort, and the requestor must be able to provide the necessary funds for materials.

A successful initial site visit leads to a follow-on detailed site visit by members of the Army unit most likely to be assigned the project. Following the initial site visit, all of the various environmental studies, agency coordinations, and real estate actions are also initiated. During the follow-on site visit, a bill of materials will be developed for the customer's review. It will provide the unit the information it needs to prepare a detailed operations order.

Needless to say, this can be a complex, torturous process which can be easily halted along the way by environmental concerns, uncooperative landowners, or the discovery of archaeological sites. During the past year, JTF-6 has discovered more than 140 previously unknown historical sites, more than half of which were eligible for inclusion in the National Register of Historic Places. Projects had to be designed to avoid any impact to these sites. Likewise, the task force has discovered a number of threatened and endangered species along the border.

In the end, it has all proved exceptionally rewarding. Engineers have improved nearly 200 miles of border roads, constructed seven ranges, several operations centers, seven helipads, listening and observation posts, boat launch ramps, eight miles of border fence repair, and numerous other projects.

The road projects have increased access to the border, reduced response times to triggered sensors, reduced wear and tear on vehicles, and contributed to over $100 million worth of drug seizures. The fence project in California has increased drug seizures by 154 percent, illegal alien arrests by 228 percent, and reduced incidents of vehicle damage due to rock throwing from 352 in 1990 to less than 20 in 1991. The project also reduced crime in neighboring communities by more than 40 percent. Additionally, the law enforcement agencies have been appreciative, Army soldiers receive excellent training, and taxpayers are saving money.

To date, support has been provided by Army, Marine, and Navy units, both Active and Reserve Components. The participating Army units include the 39th Engineer Battalion, 52nd Engineer Battalion, 34th Engineer Battalion, 46th Engineer Battalion, 43rd Engineer Battalion, 30th Engineer Battalion, 92nd Engineer Battalion, 244th Engineer Battalion, 62nd Engineer Battalion, and the 37th Engineer Battalion. The chance to improve military skills while supporting law enforcement officials is providing unique challenges and unrivaled opportunities to the soldiers, sailors, airmen, and Marines working for JTF-6.

Acting under Congressional authority—while complying with a long-standing legal tradition of noninterference in civilian law enforcement—the military has been able to provide responsive, quality support to the anti-drug effort. And JTF-6 and Army engineers are playing a critical role in the national effort to secure a drug-free America.

Colonel Woodbury is chief of engineers for JTF-6.

(Continued from page 53)

Despite the unexpected problems, from poor weather to substandard materials, the mission was a success. By working from daybreak until early evening every day, the school was completed in 29 days. It was formally turned over to the government in a dedication ceremony on November 19. This turnover date met the original completion milestone established prior to any construction delays.

The cost breakdown for the Xepon schoolhouse mission includes:

Equipment	**Cost**
Deployment (Military Airlift Command)	$50,000
Retrograde (Military Airlift Command)	13,000
Personnel	
Per Diem	15,000
Travel	13,000
Materials and Service	
Lumber	2,100
Hardware	6,800
Block	1,700
Sand & Gravel	450
Lime	100
Land Clearing (Dozer)	600
Plywood	1,100
Gas	650
Caulk	200
Truck Loading Labor	850
Truck Transportation	9,300
Water Truck Rental	2,600
Currency Conversion	250
Total	$117,700

Conclusion

The Xepon mission was a complete success. The engineer training was first-rate, and the Army served an important role in fostering good relations with Laos. But in this small part of the "everybody-wins" nation assistance program, the real winners are the children of Xepon.

First Lieutenant Cole is a platoon leader with Charlie Company, 84th Engineer Battalion. He previously served as a staff officer for the 25th Infantry Division's assistant division engineer. He is a graduate of West Point, and the Engineer Officers Basic Course.

Observations From Just Cause

By Captain Gordon J. Taras

While the "lessons learned" spotlight remains on Desert Storm, valuable observations are still being gleaned from Operation Just Cause in Panama.

The Engineer School has collected the comments of soldiers who participated in the operation, and the information is now being evaluated for use in updating engineer doctrine. However, many of their observations can be used now by engineer leaders.

This article will provide some of the engineer experiences and recommendations that resulted from Just Cause. These observations should be helpful in preparing units for rapid deployment, direct combat, and civil-military operations.

Are You Prepared To Go?

A continuing problem in all deployments is a shortage of airframes. Most units have standing operating procedures (SOPs) specifying a light package of equipment. However, during a hectic deployment, it is sometimes difficult to convince the maneuver commander that engineer equipment also needs to have some measure of priority. Make sure that engineer assets are included in battalion/task force plans for deployment, and are prioritized by the mission essential task list (METL). Mass is usually the governing factor in load planning, but engineer-assisted maneuver and sustainment are also critical tasks.

Sleep is always an issue, both during realistic training and actual combat. It's important to plan for lack of sleep so soldiers can mentally prepare themselves to cope with it. In other words, it's a lot easier for soldiers to accept that they will get no sleep in the next 48 or 72 hours, than to be left wondering if a sleep plan is in the works.

There's a lot going on during a deployment—but there will be a lot more happening once your soldiers hit the combat zone.

To give more time to your soldiers, try not to "over brief." Concentrate briefings on your soldiers' area of operations and area of interest. It's an unnecessary distraction and waste of time to track every action in the theater of operations. Better that they get some rest while they can—or at least have the peace of mind to know what level of fatigue they will have to cope with.

Are You Prepared To Fight?

After the operation, some soldiers said they needed more training in combat skills. The first of these is MOUT (military operations on urbanized terrain) training. Cities are the centers of transportation and government. They are also the ports of entry for your resupply. During a rapid deployment situation like Just Cause, these are the first places that must be secured. Make sure MOUT training is included in your training schedule. Also, don't forget that MOUT operations are often complicated by the presence of civilians. Try using some of your soldiers as mock civilians during MOUT training.

Combat engineers place wire obstacles around the U.S. Embassy during Operation Just Cause.

Obstacles generally unique to MOUT combat presented unfamiliar tasks for some engineers. Cars, rubble, and trash often litter the MOUT environment. While these are addressed in FM 90-10 and FM 90-10-1, most MOUT training sites do not include these obstacles in training. Insist on realism during your unit's urban combat training.

One obstacle not mentioned in the manuals is chain-link fencing. Engineer units in Panama found that simple, garden-variety chain-link fence is a significant obstacle. One solution used under fire was Bangalore torpedoes placed vertically against such fencing.

Soldiers also felt tunnel clearance needed more training emphasis. The following are just a few tunnel clearance techniques, derived from *The Tunnels of Cu Chi*, by Tom Mangold and John Penycate:

- Enter a tunnel with a minimum of three soldiers
- Leave two soldiers at the entrance
- Keep five meters apart within the tunnel—or within sight each other
- Leave one soldier at each intersection
- Avoid using grenades and demo while in tunnels (explosives rob your oxygen)
- Exit with a visual signal (flag or rifle)—not your head
- Use infrared light with night vision goggles in tunnels

MOUT vehicle hardening also needed work, and Vietnam era lessons learned suggest the following:

- Line vehicle cabs with flack vests and sandbags (include doors, windows, floorboards, and seats)
- Protect engines, drive trains, and tires with flack vests
- Protect troop compartments with sandbags
- Have a rear gunner in each vehicle

Soldiers also felt they needed to be more familiar with the effects of weapons on the MOUT environment, including:

- Wood frame structures
- Concrete block
- Mass concrete
- Sandbags
- Vehicles
- Chain-link fence
- Glass

An Army bulldozer takes part in clean-up operations after the main fighting was over.

Are You Prepared To Stay?

Initial assault forces should not expect early relief by follow-on units. If the initial combat actions are successful, units will transition to stability operations. Combat engineers will perform civil assistance tasks as soon as the fighting winds down. These tasks include:

- Repair airfields (also a combat task)
- Restore power, water, and sewage systems
- Remove trash
- Clear combat debris from roads
- Provide facilities and utilities to civil relief organizations

In supporting such operations, Just Cause engineers felt they needed more experience in light vertical construction. Potential sources of vertical construction training include:

- Correspondence courses
- Troop construction
- Barracks maintenance
- Range facility improvement
- Soldier apprenticeship to the local DEH (Directorate of Engineering and Housing)

As follow-on engineer activities were initiated in Panama, units experienced a shortage of hand tools. Commanders should explore the possibility of purchasing hand tools at home station, and assembling tool kits for future deployments. These tools could be sent on one of the resupply pallets. Another option is to arrange to have a couple of your officers trained and authorized to serve as purchasing officers. On deployment, these officers could buy the needed tools and supplies.

Many leaders said their soldiers do not have enough training with unexploded ordnance. The Explosive Ordnance (EO) Reconnaissance Course can provide valuable training in this area. All explosive ordnance detachments offer this 40-hour certified course. All military policemen are required to attend the course—why not all engineers?

Graduates of the course are qualified to identify and mark all EO. In combat, they are authorized to destroy EO (in place) up to 90 millimeter. In Just Cause and Desert Storm, engineer units destroyed massive amounts of EO—but some mistakes were made. This course will give soldiers first-class training on EO and help prevent accidents. Of course, destruction of large ordnance and ammunition stockpiles should be left to EO detachments.

Just Cause operations also pointed out that commanders of corps level engineer assets need to analyze their METLs for rapid deployment and low intensity conflict (LIC). In such operations, initial battlefield requirements call for small team missions over wide areas. This is primarily because immediate combat tasks are a higher priority than sustainment tasks.

As the battle settles and brigades start planning for follow-on missions, corps level assets will be relieved from attachment to forward combat units. These assets will then be allowed to reorganize for platoon and company missions. However, there will still be a need for small slices of equipment. Commanders must train junior leaders to expect—and cope with—a wide variety of missions.

The Engineer School, in coordination with the Center for Army Lessons Learned, is now addressing many of these issues by updating doctrine, training, and equipment. Engineers having additional comments or suggestions should send them to: The Engineer School, Directorate of Evaluation and Standardization, ATTN: ATSE-ESA (Captain Taras), Fort Leonard Wood, MO 65473, or call DSN 676-5317 or 314) 563-5317.

Captain Taras is an evaluation officer with the Engineer School's Directorate of Evaluation and Standardization. He previously served as a liaison officer, division tactical command post engineer, and platoon leader in the 101st Airborne Division. He is a graduate of the Engineer Officers Advanced Course. He received his commission from West Point.

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ENGINEER UPDATE

Defense System Network (DSN) numbers are 676-XXXX and commercial numbers are (314) 563-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

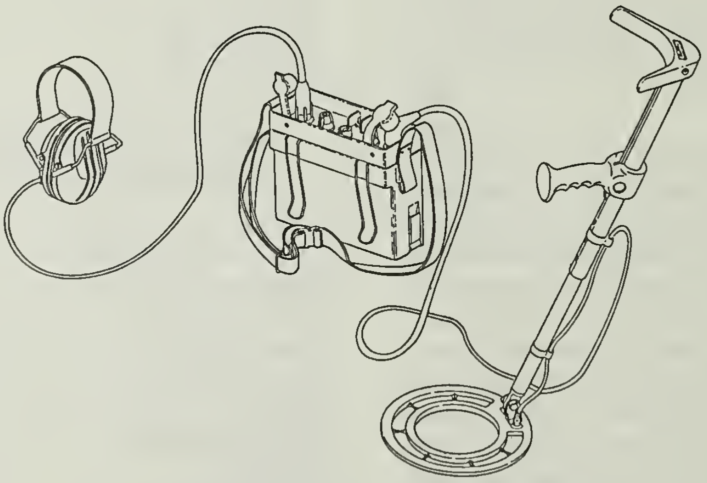
MOS 52E Self-Development Tests (SDT). The FY 93 SDT will test only the Soldier Training Publication (STP) tasks in subject areas 1, 2, 3, 4, 5, and 22. These subject areas and tasks are in the three 52E STPs dated August 1988. Questions will be taken from the references listed at the end of the task summaries. All organizations with 52E NCOs should ensure their library includes these references. POC is Jim Evans, -7510.

Preliminary Self-Development Test Scores (SDT). Analysis of Army-wide scores on the SDT show that NCOs are scoring significantly lower on the Training segment than on the Leadership and MOS Specific segments. While no engineer soldiers' scores were available for comparison, NCOs may want to spend more time preparing for the Training part of the SDT. POC is Jim Evans, -7510.

Combined Arms Training Strategy (CATS). Engineer unit CATS is scheduled for distribution as a special publication in May. Units are requested to use their respective strategy and provide feedback to DOTD on DA Form 2028 before September 30. ARTEP 5-402-33 (Engineer Brigade and Group Headquarters), the first MTP to incorporate CATS, will be fielded in the 3rd quarter of FY 93. POC is CPT Frank Barry, -7594.

Directorate of Combat Developments (DCD)

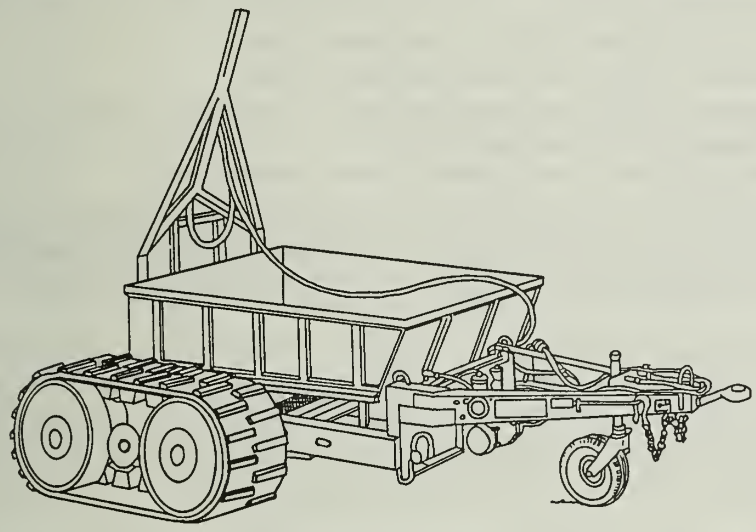
AN/PSS-12 Hand Held Metallic Mine Detector fielded. Distribution of the new AN/PSS-12 hand held mine detectors began on March 20, 1992. The U.S. Army Troop Support Command has awarded a contract to purchase the Schiebel mine detector, which will replace the aging AN/PSS-11 model. The first units equipped will be the 27th, 37th, and 307th Engineer Battalions, Fort Bragg; the 13th Engineer Battalion, Fort Ord; and the 326th Engineer Battalion, Fort Campbell. POC is SFC Michael Craig, -7993.



AN/PSS-12 Hand Held Metallic Mine Detector

Illustration by Richard vonHaeger

MICLIC/Tracked Trailer Upgrade. The U.S. Army Tank and Automotive Command has accepted the first three tracked trailer kits that will be used to upgrade modified M200 trailers. The 24th ID (mech), the first unit to be equipped, is scheduled to receive their upgraded trailers by May. Other units scheduled to receive the tracked trailers are (in order of priority) the 1st Cav Div, 3d ACR, 3d ID (mech), 1st AD, 11th ACR, V Corps, 2d ID, and 1st ID (mech). Additional tracked trailers will be designated for the Engineer School, the Ordnance School, and the National Training Center, Fort Irwin. POC is CPT Jon Siltala, -7323.



MICLIC/Tracked Trailer

Illustration by Tammy Morris

Field Assistance in Science and Technology (FAST) Program. Field Commanders can use the FAST program to get solutions to technical materiel problems. The program provides a link between soldiers in the field and scientists and engineers in the Army's research, development and engineering centers. In its 5 years of existence, the program has documented many successes, including development of a gun tube exerciser for tanks in storage. For information, call your science advisor or FAST Headquarters at DSN 354-5482, or (703) 664-5482. POC is Merrill Stevens, -7500.

Systems Engineering. The Engineer Center makes every effort to purchase equipment and field systems that are dependable, easily maintained, and free from hazards to operators and maintenance personnel. But no system can be designed for every possible environmental condition or operational scenario. We need feedback from field personnel about problems encountered on the job. Report potential hazards or design flaws in engineer equipment to your Safety Engineer (-7346) or Reliability Engineer Team (-7969/7976). Your input will be incorporated into the design process for a new system, or used to develop countermeasures to fix the problem. POC is Mark Totzke, -7346

Department of Instruction (DOI)

Unit Designation Terminology Changes. Unit designations have changed as a result of the Engineer Restructure Initiative (ERI). Field Manual (FM) 101-5-1 (*Operational Terms and Symbols*, dated 1985) will be updated when FM 100-5 is rewritten in 1993. Until the revised FM 100-5 is available, field units should use the following unit designations:

Division engineers (DIVEN) units:
- Sapper battalion (put type of unit)
- Sapper company (put type of unit)
- (Unit types are: armored, airborne, airassault, light)

Corps engineer units:
- Combat engineer battalion (put type of unit)
- Combat engineer company (put type of unit)
- Combat support equipment company
- Bridge company (put type of unit)
- (Unit types are: mechanized, wheeled, ribbon, MGB)

The term "Armored" replaces "Heavy" in maneuver unit designations (TRADOC PAM 525-5, 1 August 1991, page 10). We now have armored battalions, light battalions, and armored/light operations. POC is MAJ Kenneth Dobbins, -5802.

River Crossing Terminology Changes. The Combined Arms Center has agreed on terminology for FM 90-13, River Crossing Operations. The manual is scheduled for distribution in the 4th quarter of FY 92. A river-crossing operation will have four phases: Advance to the river, assault crossing of the river, advance from the exit bank, and secure the bridgehead line. Three forces will be involved:

Bridgehead force - responsible for seizing and securing the bridgehead.

Support force - responsible for providing direct and indirect fires to the bridgehead force and controlling the crossing area.

Breakout force - responsible for passing through the bridgehead to continue combat operations. POC is LTC Allan Carroll, -5807.

Doctrinal Writers Request Ideas. If you have a system, drill, or workable idea to share, send it to the DOI staff. Good ones may be included in future doctrinal field manuals. Send suggestions to U.S. Army Engineer School, Attn: ATSE-DI-TT, Fort Leonard Wood, MO 65473. POC is LTC Allan Carroll, -5807.

Engineer Personnel Proponency Office (EPPO)

Army Divers Needed. The Army is seeking volunteers for Military Occupational Specialty (MOS) 00B (Diver). Soldiers who qualify and graduate from the Navy Diving and Salvage Training Center will be assigned to Engineer Diving Detachments. These detachments provide specialized underwater support for all missions in the Army theater of operations and are presently located in Europe, Panama Canal Zone, Korea, and Fort Eustis, Virginia.

Diving detachments are capable of diving operations involving scuba (self-contained underwater breathing apparatus) and deep sea surface supplied air equipment. Due to the hazardous operating environment, divers receive an additional $110 special pay. To apply, soldiers must comply with criteria utlined on the Marine Diver Training Application (DA Form 5030-R, Nov 90). or more information, call the Army Liaison Office, Naval Diving and Salvage raining Center, DSN 436-5261. POC is SFC Don Eelman, -5706.

DA Pam 600-3 Revised. Publication of the revised DA Pam 600-3, “Comnissioned Officer Development and Career Management,” is scheduled for the th quarter of FY 92. The updated pamphlet will clearly define the standards of ualification at each grade, delineate key branch assignments in addition to the raditional “command track,” and illustrate typical Reserve Component developnental patterns and requirements. POC is LTC Buck, -6337.

Reserve Component (RC)

EOAC-RC Program Changes. The Engineer Officers Advanced Course-RC EOAC-RC) will change from four phases to two phases in October 1993. Efective October 1, 1992, officers will be unable to enroll in the four-phase OAC-RC program. Officers currently enrolled will have until September 1993 o complete any remaining phases of the four-phase program. Those who fail to lo so will be required to take the new two-phase course. This means that work lone in the old course cannot be carried forward to the new course.

The new EOAC-RC will consist of Phase I, Correspondence; and Phase II, esident. Officers must be at least a first lieutenant to enroll, and will have two ears from the date of enrollment to complete the work. The new course is lesigned so that knowledge gained during the correspondence phase will be einforced by practical exercises conducted in the resident phase.

Enrollment for Phase I (Correspondence) of the new course will begin in anuary 1993. Phase I will contain 120 hours of correspondence studies and vill be a prerequisite for attendance at Phase II.

Training for the new Phase II (Resident) EOAC-RC will begin in October 993. Phase II will be two weeks of resident training at the Engineer School.

The Army Correspondence Course Program (ACCP) catalog, DA PAM 351-0, and the Army Training Requirements and Resources System (ATRRS) will e updated to reflect the new course requirements.

POC is COL Shoff, -6336.

Engineer RC Weekend Refresher Classes Cancelled. The Engineer chool will not conduct engineer RC weekend refresher classes in FY 92. hose refresher topics generally are available to the RC through their respecve Readiness Group or Engineer Team.

A 5-day engineer staff refresher course will be taught at the Engineer chool on September 14-18, 1992. Units can obtain seat quotas for this ourse by calling the Deputy Assistant Commandant-RC office (Ms. Holand) at -7742/6336. Address questions concerning course content to the epartment of Instructions (CPT Singleton), -5747. Address questions conerning Reserve Component Configured Courseware (RC^3) to the Direcorate of Training and Doctrice (MAJ Davison), -7522. POC is MAJ avison, -7522.

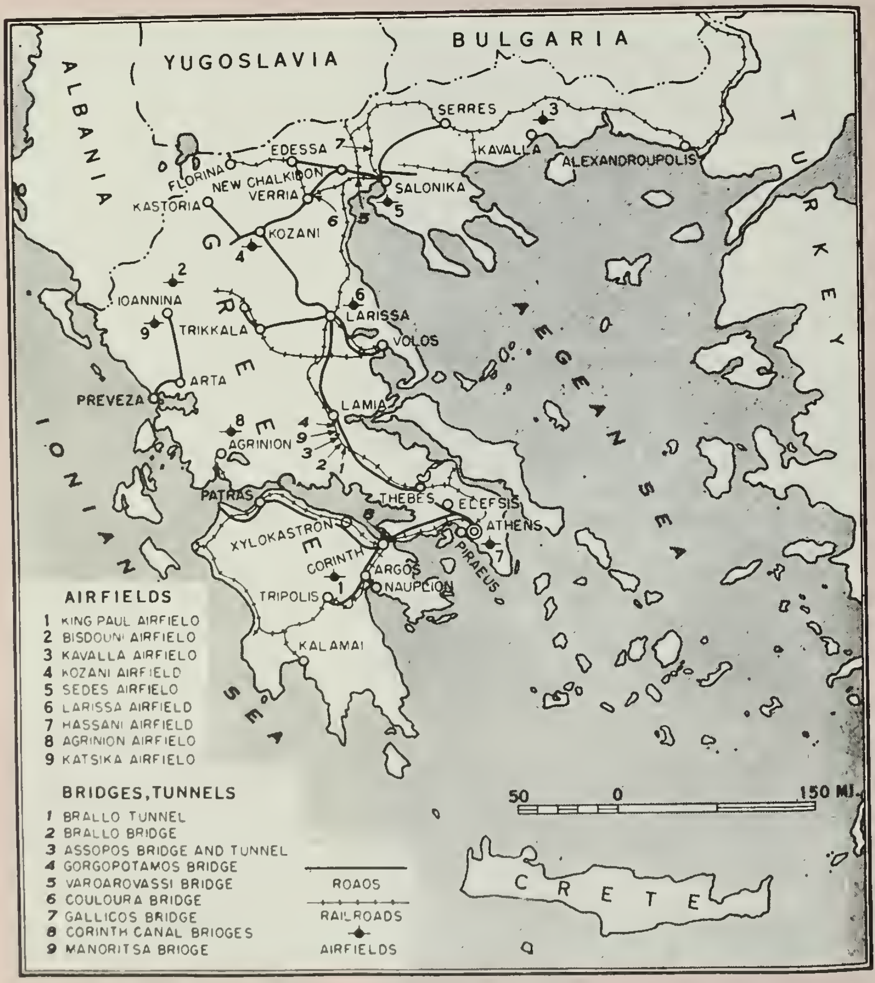
Corps Rebuilt Greek Infrastructure

"to help friendly nations help themselves"

By Dr. Paul Walker

When the U.S. Army Corps of Engineers has engaged in major international activities during the post-World War II era, it has used its district organization as a model to manage the work. The approach is firmly grounded on experience. The Corps' involvement in Greece between 1947 and 1949 set the pattern.

At the end of World War II, Greece stood in virtual ruin. During the German occupation, which lasted until October 1944, the economy nearly collapsed. Allied bombing raids destroyed miles of railroads and devastated the major port cities of Salonika, Volos, and Piraeus. A combination of heavy military traffic and neglect left the country's highway network in a precarious condition. Then, as the Germans withdrew, they blew up bridges, highways, and portions of the 4-mile-long Corinth Canal, which was a vital link between Athens and the Adriatic Sea.



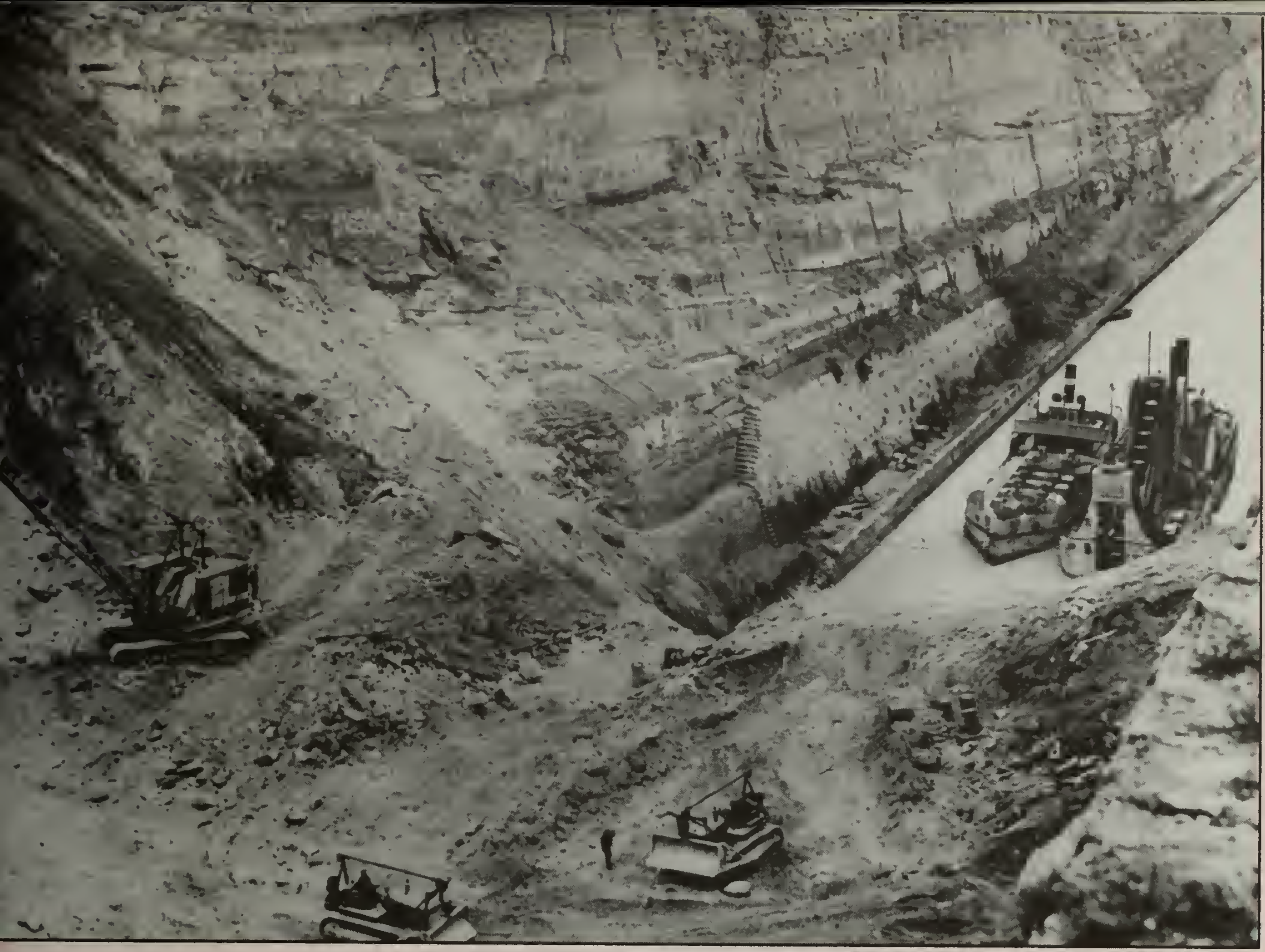
Corps of Engineers projects in the Grecian reconstruction program, 1947-1949. (Map reprint from 1949 *Military Engineer*)

British troops entered Greece and restored the monarchy as the Germans left, but conditions scarcely improved. A strong communist-led Greek underground had formed during the war, survived, and challenged supporters of the king. Unable to manage the situation, British officials informed the United States that they intended to withdraw by April 1, 1947.

The threat of civil war and the possibility of a communist takeover convinced President Harry Truman that America had to act quickly. In March the President asked Congress for $400 million in aid for Greece and Turkey. "It must be the policy of the United States," he argued in what became known as the Truman Doctrine, "to support free peoples who are resisting attempted subjugation by armed minorities or by outside pressures." The primary way to accomplish this, he concluded, was "...through economic and financial aid which is essential to economic stability and orderly political processes."

Congress wasted little time. On May 22, President Truman signed an Interim Aid Bill establishing the American Mission for Aid to Greece (AMAG). Less than a month later, expanding on the principles of the Truman Doctrine, Secretary of State George Marshall proposed his plan for long-term economic recovery for all European nations. By spring 1948, the Marshall Plan was channeling dollars to Europe through the Economic Cooperation Administration. Some of the money supplemented AMAG funds for Corps projects already underway.

To address the immediate crisis in



he Dedge *Poseidon* (right center) at work clearing the Corinth Canal. (Photo courtesy SACE Office of History, Research Collection)

reece, AMAG focused on restoring he ports and transportation system. s word spread in late spring 1947 hat the program would include contruction projects, the State Departnent received nearly 100 inquiries om interested American firms. Lackng experience in contracting and contruction, the State Department ought advice from the U.S. Army orps of Engineers, an agency with a roven record in contracting and contruction management.

AMAG's Reconstruction Division nd the Corps weeded the list of ualified contractors down to 26 but greed that joint ventures would be he most effective approach. The two rganizations cooperated closely uring contract negotiations, and two ontracts were finally awarded. The J. ich Steers Company and Grove-Wilon-Shepherd and Kruge, as the joint enture Steers-Grove, would econstruct port facilities and clear he Corinth Canal. Guy F. Atkinson ompany, Johnson-Drake and Piper, and Starr-Park and Freeman, as the joint venture Atkinson-Drake-Park, would reconstruct highways, railroads, railroad bridges and tunnels, and airfields.

When State Department representatives met with the Office of the Comptroller General, they discovered that these contracts required an extensive construction organization and numerous accountants to provide the required level of oversight. They concluded that administering and supervising the contracts was also a job for the Corps of Engineers.

To manage the construction program, the Corps used its proven district organization, including some seven area offices. The Grecian District, with headquarters in Athens, was organized as part of the North Atlantic Division on August 1, 1947. The district drew personnel largely from existing Corps organizations. Colonel David W. Griffiths left his position as Galveston District commander to become the district engineer in Athens.

District personnel went to work immediately with contractor personnel and the Greek Ministry of Public Works. The contractors successfully recruited Greek nationals but had difficulty attracting American contract supervisors because of the unstable political conditions in Greece. At the peak of the recovery effort, government and contractor forces totaled 629 Americans and 12,131 Greeks.

The reconstruction program initially was scheduled to be completed in one year, and a demobilization plan was in place early. However, guerrilla activity, unusually severe winter weather, and additional new projects resulted in extensions through March 1949. Real and threatened guerrilla attacks were a major problem that resulted in about 214 incidents involving loss of life and construction time. Contractors also had difficulty obtaining equipment and supplies. They amassed the necessary materials—more than 5,200 pieces at the peak of construction—by combining items procured in the United States and Greece with items loaned by the Greek government.

The first reconstruction project was at Piraeus, a key port city that served as Athens' harbor. As elsewhere, damage there had resulted from a combination of intense British and American air raids and calculated demolition by retreating German forces. Germans destroyed or damaged most of the 3,300 meters of concrete quay walls and used machinery, steel girders, and debris to block key points in the harbor. Gone were a grain silo, conveyor system, warehouse, and equipment which served the port.

Steers-Grove, with the Knappen Engineering Company as consultants, began repairs on November 18, 1947. By December 1948, they had reconstructed 2,100 meters of quay walls. In the same 11-month period they removed 16,000 cubic meters of debris and placed 4,674 cubic meters of concrete to make the port's two dry docks operational. Dredging was a cooperative effort. The Grecian District confined itself to the area around the quay walls, while the Ministry of Public Works dredged the rest of the harbor. Steers-Grove completed similar, but less extensive work at the ports of Volos and Salonika, on the Aegean sea in central and northern Greece.

The Corinth Canal presented one of the greatest challenges. Only 7 kilometers (about 4 miles) in length, the canal could save shippers about 200 kilometers on the trip from eastern to western Greece. Damage rendered by the retreating Germans was severe. Explosions triggered at two points dumped 645,000 cubic meters of earth and rock into the canal. Other debris included a duplex highway-railway bridge, 130 railroad boxcars, six locomotives, mines, and the 3,400-ton steamship *Vesta*, which had been wrecked and sunk in the canal. Lack of maintenance had affected the entrance breakwaters, and the channel was heavily silted.

Work to repair the canal began in October 1947. The silt and debris removal effort required special equipment and had to be timed to support the overall excavation schedule. Steers-Grove used dredges, floating derricks, tugs, and dump scows in the cleanup effort. When full-scale traffic resumed in December 1948, a total of 321 ships carrying 58,838 tons of cargo cleared the waterway that month.

Atkinson-Drake-Park undertook road, bridge, and tunnel repair and eventually airfield construction. The highway networks presented a significant challenge. At the end of the war, most major highways were impassable. Ninety percent of the bridges and culverts had been destroyed. Contractors used nearly 30,000 tons of asphalt and more than 650,000 tons of aggregate to restore and surface 1,216 kilometers of highway. As district engineer Griffiths noted, the job was a worthy accomplishment "considering the mountainous topography, the unprecedented cold and snow...and the insecure conditions in all field areas." The Greek Ministry of Public Works simultaneously constructed highway bridges and secondary roads and later completed surfacing at several Corps projects.

Atkinson-Drake-Park was also responsible for reconstructing twelve steel railroad bridges, two tunnels, and a highway bridge. After this work was underway, the Greek Air Ministry requested that ten airfields be included in the Corps' contract. That effort involved new air strips and control towers as well as repairs and improvements to existing runways and administration buildings.

In Greece between 1947 and 1949, the Corps of Engineers played a significant role in carrying out the United States' initial post-World War II assistance programs involving direct economic aid. The goal was to rebuild the national infrastructure, which would provide the basis for economic recovery and political stability. Dedicated to containing communism, American policymakers believed the future of the entire region was at stake.

While the engineers' work was only part of AMAG's total aid program, it was a most visible part that was appreciated for many years. Once Corps' contracts were completed, the district organization closed down. Thus the Corps demonstrated very early that it could put together an effective organization rapidly and disband it just as quickly.

Beginning in the early 1950s, the Corps returned to the Mediterranean region as part of economic aid and more ambitious military assistance and reimbursable programs. Over the ensuing decades this included programs in Saudi Arabia, Turkey, Iran, Pakistan, Afghanistan, and North Africa, as well as Greece. In nearly every instance the Corps employed many of the same approaches evident in their initial effort in Greece: use of the engineer district organization, provision of technical assistance in conjunction with economic aid, and training indigenous contractors and workers to perform as much of the work as possible. The total effort was designed to help friendly nations help themselves.

Today, the Corps is involved in numerous international activities in support of CINC South, the Department of State, the Agency for International Development, and Voice of America. The Corps does not possess separate program authorities and funding for international work, but stands ready when deemed appropriate to become involved in additional projects.

Dr. Walker is chief, Office of History, Headquarters, U.S. Army Corps of Engineers, Fort Belvoir, Virginia.

Sources:

Dod, Karl C., "Overseas Military Operations of the Corps of Engineers, 1945-1970," unpublished manuscript, Office of History, Headquarters, U.S. Army Corps of Engineers, Fort Belvoir, Virginia.

Griffiths, D.W., "Reconstruction in Greece," *Military Engineer*, XLI (July-August 1949): 252-257.

BRIDGE THE GAP

By Command Sergeant Major Richard N. Wilson
U.S. Army Engineer School

As Army leaders struggle with the build-down, many Noncommissioned Officers (NCO) are struggling with career decisions. Now more than ever, many NCOs are asking what they can do to remain competitive throughout their Army careers.

The promotion board for sergeants first class recently identified criteria used to select the "best qualified" candidates for promotion. An analysis of their selection process provides valuable insight into career planning and promotion opportunities.

The board used evaluation reports (NCOER) as a tool when selecting individuals for promotion. Concise, hard-hitting, factual ratings with bullet-type comments carried the most weight. For example, scoring 300 on the Army Physical Fitness Test (APFT) was a bullet of excellence. Conversely, vague, wordy, meaningless, or unsubstantiated ratings carried little weight and tended to penalize a soldier.

Senior raters' comments on an NCOER concerning the soldier's "potential" were a key factor in an assessment, but were included in only 50 percent of the records. However, a "nonconcurrence" by a reviewer adversely impacted a rating because of the higher rank and experience of the reviewer and because that option is seldom used.

Successful completion of appropriate Noncommissioned Officers Educational System courses was another key factor. Selection for a course indicated a soldier's potential, and graduation signaled competence. College credits were not a requirement for selection, but the presence (versus absence) of credits did become a factor. Given the Army's goal for post-secondary education, NCOs must show initiative through a program for self-development.

The board looked for leadership positions and compliance with DA guidance to clearly define responsibilities in terms of soldiers, material, equipment supervised, and special duties. An NCOER that adhered to this guidance provided a much stronger picture of the soldier's training and experience.

Several "show stoppers" that can effectively end or severely hinder a soldier's career were identified. These included failed skill qualification tests (SQT), exceeding weight standards, letters of reprimand, and misconduct offenses under UCMJ.

The board critically evaluated issues surrounding values, ethics, and discipline in the NCO Corps. Recent incidents, especially those occurring in an NCO's present grade, affected the rating. The use and abuse of alcohol was the most damaging problem. Driving under the influence (DUI) was the detrimental factor that eliminated most otherwise fully qualified NCOs from the promotion list.

Inconsistent enforcement of standards was apparent in some records, and the board raised serious questions about the validity of "meeting height/weight standards" in accordance with Army Regulation 600-9. For example, records showed that some NCOs' height increased as their weight increased, and decreased as their weight decreased. Also, some photographs did not support the statement "meets body fat standards." This area needs fixing! NCOs *must* meet screening weight and body fat criteria and appear fit.

Photographs remain a powerful tool. Lack of a photograph, when coupled with questionable height/weight status, conveyed a negative impression and typically prompted an inquiry.

Physical fitness and weight control are areas where many NCOs need improvement. Analysis of promotion board decisions indicate that exceeding the standards for physical fitness benefitted an individual, while poor performance lowered the overall assessment.

The board recommends the following criteria for NCOs and their leaders: All newly promoted NCOs should serve 12 months in a leadership position and attend the next higher leadership school before being assigned outside their career management field. Also, special duty assignments should not exceed 4 years (i.e. drill sergeant, instructor duty, garrison staff, readiness duty, or back-to-back TDA assignments). After 4 years, these assignments become a detrimental factor, not an enhancing one.

Our ability to sustain a high-quality force during this period of diminished advancement opportunities is a challenge facing all combat arms leaders. We, as engineer leaders, can help meet this challenge by educating our NCO Corps about factors affecting their careers. We must guide and support our NCOs as they face the challenge of a smaller but more demanding Army.

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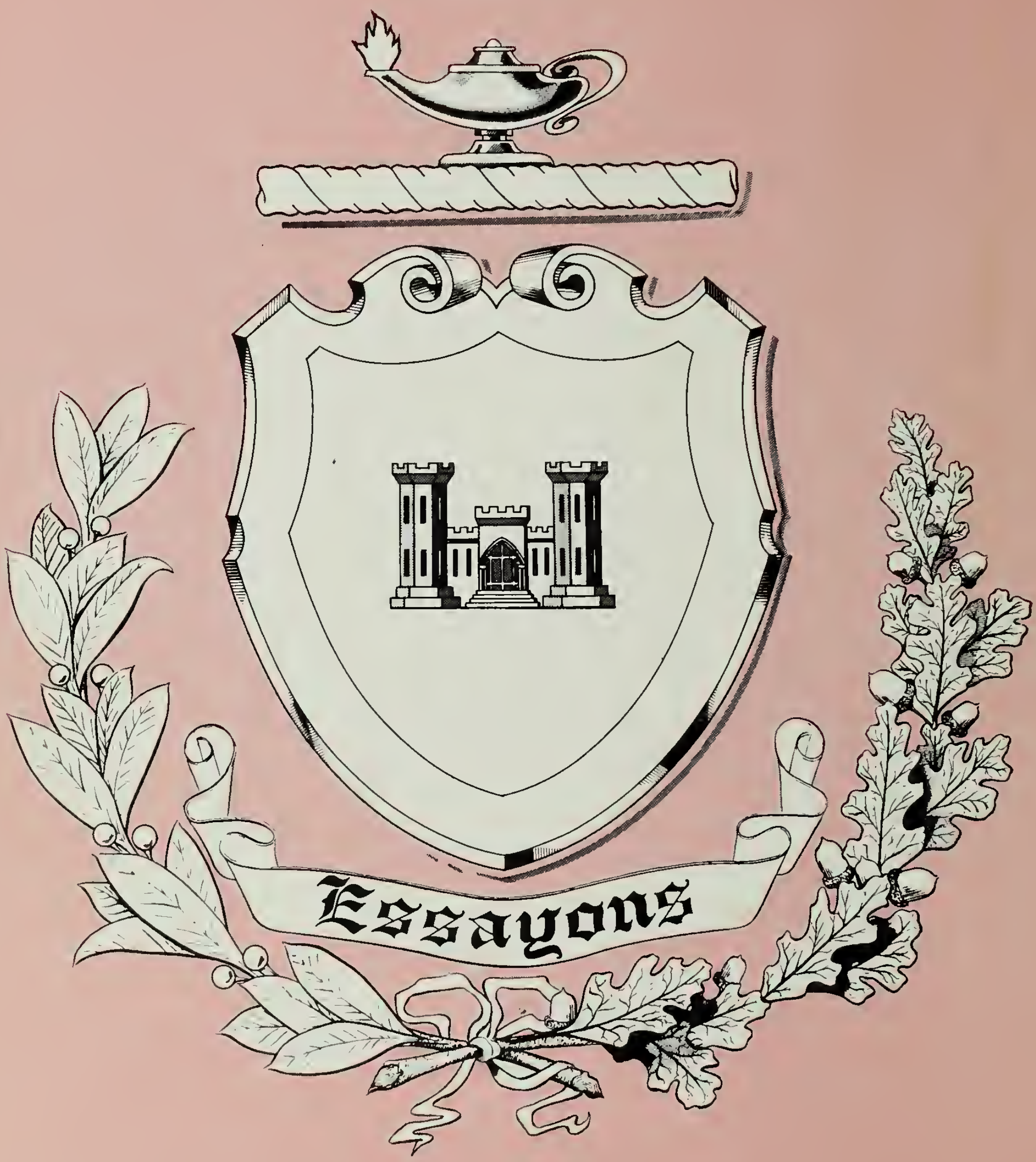

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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

Our Army is entering a period of self-examination and reflection. The continuing change and violence in the world emphasize the fact that the missions for our Army are as critical as ever. Many old planning assumptions are no longer valid, however. We must now prepare our Army for the future, a task that is not as straightforward as it may seem. In the past we prepared to meet our most likely challenger. Today we must prepare for the unknown. To serve our nation effectively, we must be prepared to meet any threat—not just the most likely known threat, but any threat. That is a monumental challenge—how does an Army develop leaders, write doctrine, field weapons, and conduct training for the unknown?

In April, your Engineer Center hosted the 1992 Senior Engineer Leaders' Training Conference, or SELTC. The theme of this year's conference was "Shaping the Force for the 21st Century" a timely topic! In the course of the SELTC, several key Army leaders gave their vision of the future Army and addressed some of the steps toward that vision. General Gordon R. Sullivan, Chief of Staff of the Army, gave the keynote address which set the tone for the rest of the conference. His remarks are included in this issue of *ENGINEER*, beginning on page 24. General Edwin Burba, commander of the Army's Forces Command (FORSCOM), and General Frederick Franks, commander of Training and Doctrine Command (TRADOC), provided insights into how their organizations will help shape the Army of the future. Lieutenant General Henry Hatch, our Chief of Engineers, gave the closing presentation. He made some very thought-provoking observations on how our Corps must continue to adapt to meet the needs of the Army and the nation. He emphasized that, as our Army gets smaller and increases its emphasis on power projection, we must be able to tailor engineer forces to accomplish whatever missions we are assigned. These tailored forces will often include both Active and Reserve Component forces. General Hatch concluded with a definition of "decisive victory" that is especially applicable to the engineer force: the return to sustainable peace.

Finally, some specifics on near-term efforts to prepare the Army for the future. On doctrine, the Combined Arms Command at Fort Leavenworth continues to work on the revision of FM 100-5, *Operations*. A first draft of this manual will be published in late August or early September. A TRADOC working group, composed of some of TRADOC's visionaries, is laying the groundwork for a series of six "battle labs" that will address evolving battle dynamics. One lab will address each of the following: early entry operations, battlespace (range of combat actions) in mounted operations, battlespace in dismounted operations, depth and simultaneity of operations, command and control and tempo of operations, and logistics. The labs will look at how these dynamics will affect future Army operations. They will be linked to a Chief of Staff of the Army initiative known as the "Louisiana Maneuvers," which will integrate and build upon numerous exercises and simulations Army-wide. The Louisiana Maneuvers will serve as a vehicle to assess doctrine and organizations, refine concepts, develop leaders, and train the force. More about the Louisiana Maneuvers will appear in future issues of *ENGINEER*.

As you look at the table of contents of this issue of *ENGINEER*, you cannot help but be struck by the diversity of tasks expected of us as engineers. This diversity is one reason why in the future, as in the past, engineers will "lead the way" in Army operations. We must work together to shape our Army so that it may best serve our nation. Essayons!

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Cover: Students are given an orientation ride on a MK II Bridge Erection Boat during float bridge training at Fort Leonard Wood. (Photo by Phil Howell)

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Desert Storm

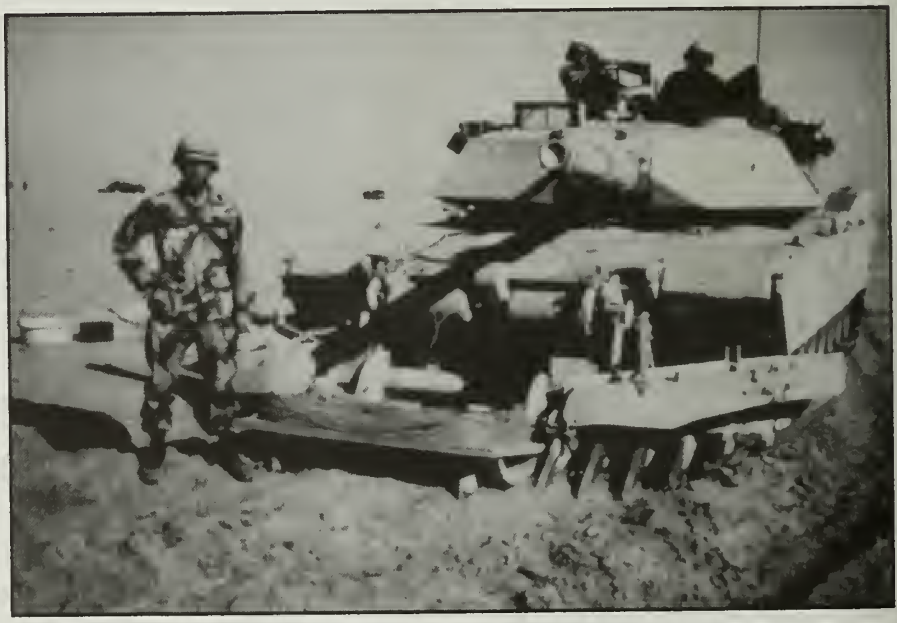
Countermine Improvisations

By William Schneck

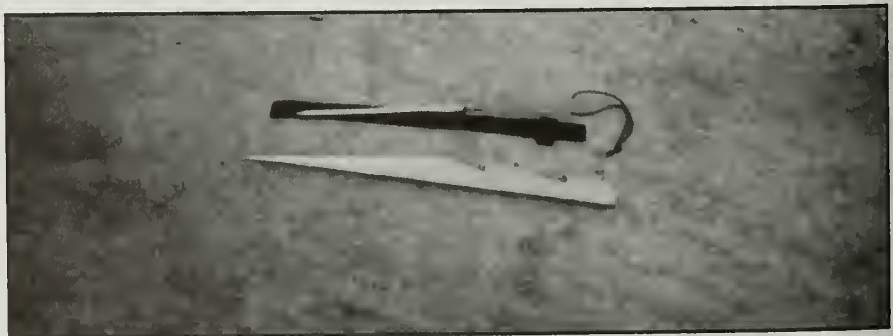
American combat engineers have a long tradition of improvising methods to accomplish their mission. Their remarkable ingenuity is second to none. And they proved themselves once again during the Gulf War, when standard countermine measures were found lacking.

Just before the ground phase of Operation Desert Storm, it became painfully obvious that the lack of modern countermine equipment hampered the ability of American and other coalition forces to successfully complete an opposed breach. The Iraqis were reported to possess a wide variety of advanced land mines from a large number of countries, particularly Italy and the Soviet Union.[1]

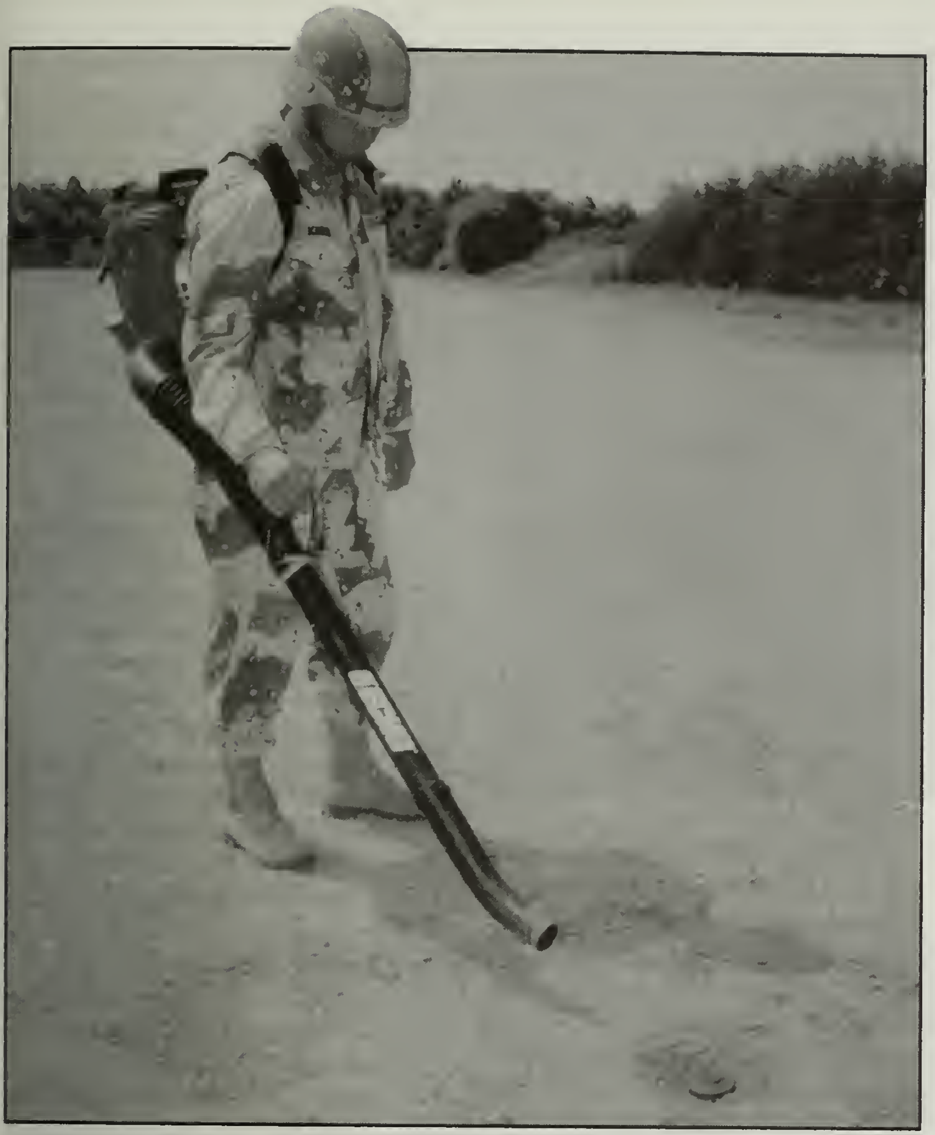
American combat engineers were told to expect mines that were far more sophisticated than any of the conventional mines then available in their own inventories. The arrival of the armored combat earth mover (ACE), the battalion countermine set, and the combat engineer vehicle (CEV) mine rake significantly improved the breaching capabilities of our forces. However, it did nothing to help the breaching abilities of



The M1-mounted Vehicle Magnetic Signature Duplicator (VEMASID), improvised by the 1st Infantry Division to counter the threat of seismic-magnetic-fused AT mines. (Photo by Colonel Greenwalt)



Seismic-magnetic-fused mines required the use of non-metallic probes, like the BRDEC-manufactured fiberglass probe (top) and a cut-down wooden tent stake. (Photo by William Schneck)



Small, commercially available air blowers were effective for exposing mines buried in desert soil.

light units like the 82nd Airborne and the 101st Airborne.

The light units were assigned critical missions along the western flank of the Desert Storm attack. They were charged with isolating the Iraqis in the Kuwait theater of operations. As a result of this situation, a variety of improvised countermine devices were developed by engineers supporting these units. Many of the devices worked well and should be included in every engineer's "bag of tricks."

The Threat

Most of the improvised devices were developed in direct response to the types of mines reported to be in the Iraqi inventory. The majority of Iraqi antitank (AT) and antipersonnel (AP) mines were believed to be low-metallic-content, blast-overpressure-protected blast mines which could be fitted with integral antihandling devices. These mines are difficult to detect with the AN/PSS-11 mine detector, and are resistant to the mine clearing line charge (MICLIC).

Another Iraqi AT mine was the seismic-magnetic-fused, full-width attack mine. This mine is very resistant to clearance by a MICLIC. The mine's shape or platter-charge kill mechanism is typically fatal to the crew of any vehicle that activates one. The seismic-magnetic fuse also functions as an integral antihandling device.

The Iraqis were reported to possess off-route AT mines that can penetrate the side of a tank up to 100 meters away. Some fuse types used with this mine cannot be defeated by MICLIC or the battalion countermine set. This mine must be visually detected and neutralized by .50 caliber machine gun fire or other means.

The Iraqi stock of tripwire-activated AP mines was reported to be large. This mine has a lethal radius of up to 30 meters for bounding mines and up to 200 meters for directional mines. The tripwires on these mines are very difficult to detect visually.

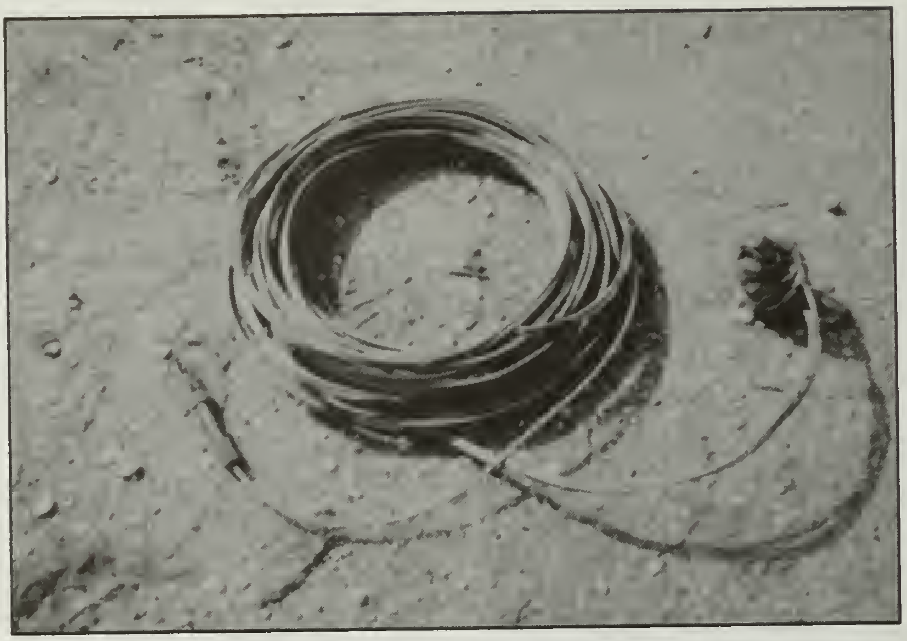
The Iraqis were also believed to have the capability of scattering mines into coalition areas of operation by a variety of means. This capability could have seriously disrupted the movement of follow-on units and supplies.

A more detailed assessment of Iraqi mine warfare capabilities is in the *Mine Recognition and Warfare Handbook* (available from the Engineer School, DSN 581-6225), or the *Sapper Countermine Guide* (available from the Belvoir Research, Development and Engineering Center (BRDEC), DSN 654-2446).

Improvised Equipment

The devices developed for Desert Storm were based on similar items improvised during World War II, Korea and Vietnam. Improvisations were also drawn from items under standard development programs during that period.

The information presented here is not intended to cover all improvisations. Rather, it will illustrate some improvised countermine devices and techniques that may prove useful. While



An improvised "mini-MICLIC," consisting of three 50-foot strands of det cord, a fragmentation grenade, blasting cap, and time fuse. (Photo by William Schneck)

these ideas have direct mission applications, it is more important that they provide "food for thought." Hopefully, this will assist in developing similar—or different—improvisations when faced with difficult situations on the battlefield. Before any improvised device is used in combat, however, I strongly recommend that it be tested as thoroughly as possible to determine its safety and reliability.

Detection

Dismounted: The bayonet has served as a mine probe in previous wars. However, the suspected presence of seismic-magnetic-fused AT mines made the use of the bayonet hazardous. A limited number of units had fiberglass probes from squad sapper sets which were prepared by BRDEC in response to a request from the 20th Engineer Brigade (Airborne). The 5th Special Forces Group (Airborne) cut down wooden paint paddles to use as probes. Other units improvised non-metallic probes by whittling down wooden tent stakes.[2]

Both the 20th Engineer Brigade and the 1st Infantry Division purchased small, commercial air blowers to supplement the AN/PSS-11 mine detector. The blower is effective for uncovering mines hidden by loose vegetation or soil. It also proved faster and more reliable than a metal detector for clearing footpaths in a dry environment. The noise and dust signatures of these blowers are an obvious disadvantage, making them useful only in areas not covered by enemy observation and fire.[3]

Soldiers of the French 6th Engineer Regiment (Foreign Legion), veterans of combat in Chad, recommended dragging an entrenching tool over the ground in a sweeping motion. This action removes the loose soil covering shallow mines without activating them. This method is much faster than probing. Before using this technique, the area should be checked for tripwires. If magnetic-fused mines are thought to be present, this technique should not be used because steel in the entrenching tool may activate these mines.[4]

Visual detection has generally proven to be the most reliable method of mine detection. In Vietnam, for instance, about one-third of the mines and booby traps were located visually.[5] During Desert Storm, visual detection again proved to be the most effective method of detection. Wind and rain had eroded the desert soil around many of the mines, making them relatively easy to spot.

Mounted: Personnel from the 1st Cavalry Division reported that they were able to locate buried mines at close range (up to 100 feet) using the thermal sights on their M-1A1 tanks.[6] Extensive research on thermal mine detection has been conducted at BRDEC. Findings indicate that sightings occur when the temperature difference between the mine and the ground exceeds the thermal sight's sensitivity threshold. This difference in temperature is the result of the different heat absorption and retention rates of mines and the soil in which they are located.

Because of this phenomenon, thermal sighting can only be conducted at certain times of the day—depending on weather and soil conditions. Unfortunately, there is no universal timetable or formula for determining these times. Soldiers must conduct tests in the breaching operations region to help identify likely times during the day when thermal detection is feasible. Because these time periods are limited, thermal detection should be considered a supplement to other means of detection, such as mine rollers and the AN/PSS-11. It is not a primary means of detection.

Breaching

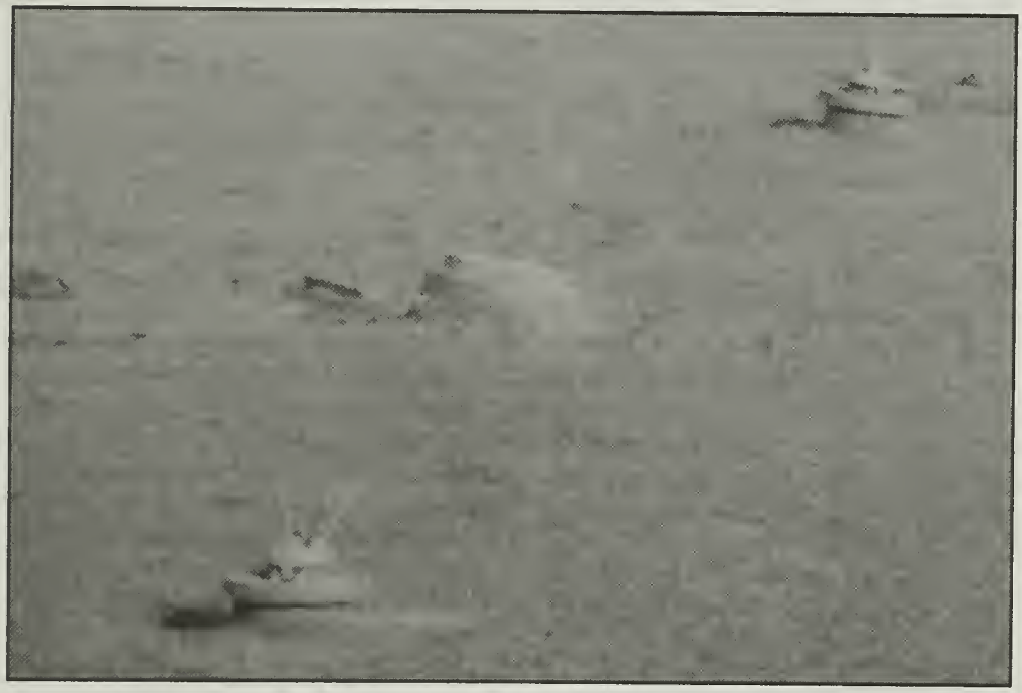
Dismounted: To clear tripwire-fused mines, several methods of projecting a grapnel into a minefield were tried. The most effective grapnel was manufactured on site by the 27th Engineer Battalion (Airborne). Based on a design by Steve Bennett, formerly of BRDEC, the grapnel was machined from 1-1/2 inch-diameter 7075-T651 aluminum rod. The grapnel had a range of about 80 meters when fired from an M-16, using a blank round, reloaded with the same amount of propellant as the standard 5.56. The grapnel deployed military-standard nylon cord, commonly called 550 cord or parachute cord. The grapnel was then retrieved, clearing tripwires and leaving a visible mark on the ground. (See "The Bullet Trap" in the April 92 issue of *Engineer* Professional Bulletin.)

Another approach was used by the 37th Engineer Battalion (Airborne). They successfully used a crossbow to launch a small grapnel into minefields. The grapnel was improvised from a three-pronged fishing hook taped to the end of a crossbow bolt.[7]

Several units improvised "mini-MICLICs" by taking three 50-foot strands of det cord and taping them in a bundle. One end is wrapped around an M67 fragmentation grenade and taped into place. The other end is primed with a blasting cap and time fuse. The det cord must be coiled to ensure proper deployment. The cord is deployed by simply throwing the grenade into the minefield (*Do not pull the pin* on the grenade).

When this device is activated, it will cut slack or taut tripwires and surface-laid or shallow-buried command firing wires. It will also detonate simple pressure-fused AP mines and displace or expose blast-resistant AP mines along a narrow footpath. The detonation leaves an obvious scar on the ground. The grenade, which is detonated by the det cord wrap, leaves a shallow crater that can be located during periods of limited visibility to mark the end of the

The Barrett .50 caliber sniper rifle, used by the Marines to clear mines.


Modern, sophisticated mines like these Valmara 69 bounding APs, and VS-2.2 AT necessitated some rapid improvisations by engineers during the Gulf War. (Photo by Tom Reeder)

breached lane.[8] A longer length of det cord can be deployed up to 50 meters by the rifle-launched grapnel.[9]

Bravo Company of the 27th Engineer Battalion used small arms fire to clear DP-ICM and cluster bomb duds (BLU-61s and BLU-97s) at Al Bussayyah, Iraq. This technique normally required five or six shots from the prone position at a distance of about 25 meters to achieve results. All submunitions hit by M-16 fire were destroyed. Unfortunately, this left the soldier uncomfortably close to the dud when it detonated. Nevertheless, this technique may be useful in some situations. The Marine Corps also used their .50 caliber Barrett sniper rifles to clear a large number of mines in their sector.[10]

The 307th Engineer Battalion (Airborne) found that blowing AT mines in place left unacceptably large craters along the breached lane that would be used by wheeled vehicles. To counter this problem, they developed a technique for blowing the mines out of the way with block explosive. Placed the right distance from the mine, the block explosive would throw the mine out of the breached lane without activating it. The optimum amount of explosive and separation between the charge and the mine must be determined experimentally for each type of AT mine.

Furthermore, this technique may not be effective against odd-shaped mines like the British bar mine. It will also cause mines with seismic-magnetic fuses and anti-handling devices to detonate. As a safeguard, some engineer equipment should be available to make the breached lane passable.

This technique may also be useful for clearing dud submunitions from areas such as airfields. Experience at As Salman and Al Bussayyah, Iraq, showed that if the neutralizing charge was placed alongside the submunition and detonated, the submunition was thrown clear most of the time. If the charge was placed adjacent to the fuse of the submunition and detonated, however, the submunition would be detonated.

Mounted: M1 tanks faced the danger of seismic-magnetic fused AT mines passing between the blades of a fitted mine plow and detonating under the vehicle. The 1st Infantry Division, with the assistance of Bennett, came up with an improvised Vehicle Magnetic Signature Duplicator (VEMASID) to counter this threat. It was successfully tested against an electronically fused AT mine.

The device was fabricated from 1,450 feet of #6 or #7 gauge wire coiled (about 80 turns) on a 5-foot by 4-foot tray. Power for the coil was drawn from the slave receptacle through a 200-amp fuse. The plane of the coil should be roughly parallel to the ground and overhang the leading edge of the vehicle. This device would probably be destroyed by the detonation of an AT mine, so it is sacrificial in nature. But that's much better than losing the vehicle and its crew.[11]

The armored vehicle launched MICLIC (AVLM) was improvised by the 1st Infantry Division to replace the trailers that usually carry the MICLIC. The trailers were found to be unsatisfactory because of their poor cross-country performance. The AVLM was made by downloading the bridge from the chassis of an armored vehicle launched bridge (AVLB). Two MICLIC systems were then mounted on an improvised frame above the vehicle's engine compartment. This greatly improved the mobility of the MICLICs.[12]

Proofing the MICLIC scar was a significant problem for engineers supporting the 82nd Airborne Division and the French 6th Division. The battalion countermine set is incompatible with the M551 Sheridans of the 82nd. The French also did not have equipment suitable for proofing.

To address this problem, the 27th Engineer Battalion fabricated an improvised mine-proofing roller. It had a central axle supported on both ends by fixed rollers. Eight articulated rollers were attached to the central axle. Four were pushed ahead of the axle and four trailed behind it. The articulation gave superb ground conformance.

The roller was hooked up to the towing shackles of a heavily sandbagged 5-ton dump truck by two small I-beams and pushed ahead of the vehicle. Steel plates were added to raise the footprint of each roller above 500 pounds.

The mine-proofing roller device was intended for proofing a breached lane. It was never used in combat because the 27th did not encounter any minefields that needed to be breached. This device probably would have been destroyed by the detonation of a single AT mine.[13] Similar devices were fabricated during the Vietnam War.[14]

A dozer armor kit was designed by Captain Jordan, of the 20th Engineer Brigade, and fabricated by the 46th Engineer Battalion (Combat)(Heavy). Using 1-1/2-inch-thick mild steel, a cage was built around the vehicle to defeat rocket propelled grenade (RPG) attacks. The blade was angled for dozing mines out of the way.[15]

The ability of the Iraqis to scatter mines deep in our sector represented a serious threat to supply lines. To counter this, the 27th Engineer Battalion fabricated a scatterable mine clearing system similar to one currently in development at BRDEC. The open grid chain mat literally scoops up surface-laid mines and ordnance at speeds up to 15 mph.[16]

The XVIII Airborne Corps considered artillery and aerial bombing for breaching minefields. While this technique was used in World War II by the Germans, they found that it required large quantities of ammunition to clear mines equipped with simple pressure fuses.[17]

Most of the mines in the Iraqi inventory had blast overpressure-protected fuses that are highly resistant to clearance by explosive line charges and fuel-air explosives. The amount of ammunition required to breach the minefields found during Desert Storm would have been astronomical. Such a method would also have yielded a low confidence in the effectiveness of the breach. Trial testing at the National Training Center confirmed the drawbacks of this technique.

Survivability

Mounted: The 27th Engineer Battalion armored their 2 1/2-ton dump truck squad vehicles by sandwiching a layer of sandbags between 3/4-inch plywood and bracing them with U-shaped pickets. In testing, the bags stopped NATO 7.62mm. The floor of the vehicle had two layers of sandbags as protection from mine blast.[18]

Marking: A variety of techniques were used by units for marking breached lanes: VS-17 visual recognition panels, traffic cones, chemlights, and others. Such methods were effective, but need to be standardized within a theater of operations. This is necessary to prevent confusion when units are shifted from one breach site to another in a different sector.

To mark approaches to breached lanes, the 1st Infantry Division effectively employed markers made from 4-foot by 8-foot plywood with chemlights inserted in the board. To mark the breached lane itself, chemlights were placed in clear, one-liter bottles filled with water.

The 2nd Armored Cavalry Regiment found that if diesel fuel were distributed on the ground, it left an obvious visual mark.[19] In World War Two, this technique was used by the British 7th Armored Division at the Second Battle of El Alamein.[20]

Conclusion

By its very nature, an improvised device is less reliable than a manufactured system. Nevertheless, it can provide an important capability where none existed before. In the foreseeable future, tight budgets will greatly restrict the modernization of countermine capabilities, particularly for our light forces. However, maneuver commanders will still look to their engineers to lead the way in breaching operations. These techniques may give the engineers the edge they need to continue clearing the way.

Mr. Schneck is a civilian project engineer for the Low Intensity Conflict Team, Countermine Systems Directorate, Belvoir Research, Development and Engineering Center. During the Gulf War, he was deployed to Southwest Asia with the 20th Engineer Brigade (Airborne) as an expert in countermine warfare. During Desert Shield/Desert Storm, he trained 19 U.S. engineer battalions in mine warfare techniques and Iraqi mines. Previous military assignments include company commander with the 229th Engineer Battalion (Light), and platoon leader with the 27th Engineer Battalion (Airborne). He is a graduate of the Engineer and Infantry Officers Advanced Courses, and holds a bachelor's degree in mechanical engineering from the Georgia Institute of Technology.

Endnotes

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[4] "After Action Report: Operations Desert Shield and Desert Storm," William C. Schneck, Belvoir Research, Development and Engineering Center, 12 November 1991, p. 11.

[5] *Viet Cong Boobytraps, Mines, and Mine Warfare Techniques*, TC 5-31, December 1969, p. 5-2.

[6] OP CIT, "After Action Report: Operations Desert Shield and Desert Storm," p. 5.

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Light Division Engineer Command and Control

By Major Bill Allen and Major Wayne Whiteman

Command and control of engineer assets in support of light infantry divisions is a challenge. The engineer restructure initiative (ERI) command and control (C^2) structure recognizes this challenge for heavy divisions and provides extensive assets to support multiple maneuver echelons. The light infantry division, on the other hand, has only its organic division engineer battalion (Figure 1). This battalion has a small staff, limited in both personnel and equipment.

Because of this austere arrangement, the battalion does not function at its maximum efficiency if it employs a separate engineer tactical operations center (TOC) in the traditional sense. Instead, the division engineer staff must integrate into existing tactical nodes and take advantage of their supporting structure.

This article describes an initiative which the 41st Engineer Battalion has implemented in support of the 10th Mountain Division at Fort Drum. It is an attempt to overcome the problems associated with limited light division engineer command and control assets.

Divisional Engineer C^2 Asset Comparison

10th Mountain Division	ERI
1 Divisional Engineer Battalion	1 DIVEN
ADE Section	ADE Section
S-3 Section	Operations/Plans Section
S-2 Section	TAC Section
S-1 Section	Administration/Logistic Section
S-4 Section	
	3 Divisional Engineer Battalions
3 Assistant Brigade Engineers	Assistant Brigade Engineer Section
	Operations/Plans Section
	TAC Section
	Administration/Logistics Section

(from Coordinating Draft FM 5-71-100)

Figure 1

Basic Organizational Framework

"The ultimate measure of command and control effectiveness is whether the force functions more effectively and more quickly than the enemy." (FM 100-5, *Operations*) Experienced engineer leaders must be immediately available to supported maneuver commanders to achieve this objective. Likewise, these leaders need supporting staffs to enhance their efficiency. The single division engineer battalion is not robust enough to provide support to multiple command posts and echelons in the division, in addition to operating its own separate TOC.

The 10th Mountain Division initiative allows the battalion commander to shift his focus toward directing engineer effort from a divisional—rather than a battalion—perspective. Assets of the battalion staff sections are consolidated and reorganized to create operations cells that function as part of the division and brigade tactical nodes (Figure 2).

In the division forward area, assistant brigade engineers integrate into the brigade TOCs. Personnel from the assistant division engineer (ADE) and battalion S-2, S-3, and communications sections form three cells with the division main command post (DMAIN): an engineer close operations cell, an engineer operations cell, and an engineer plans cell.

*(**Editor's Note:** DIVEN TAC is the approved term for the engineer close operations cell. This term, along with*

DIVEN REAR and DIVEN MAIN, appear in FM 5-71-100, Division Engineer Operations, *scheduled for distribution later this year. These terms have been added to the authors' own for clarification).*

The battalion executive officer serves as the rear engineer and is supported by elements of the battalion S-1, S-4, and battalion motor officer (BMO) sections. They form an engineer rear operations (DIVEN REAR) cell in the division rear command post (DREAR). The engineer administrative and logistics operations center (ALOC) is effectively collocated with the DREAR.

An engineer base is established with the headquarters company maintenance, medical, food service, and equipment support operations. It provides a central sustainment and operational base for divisional engineers and engineer augmentation units working in the division area.

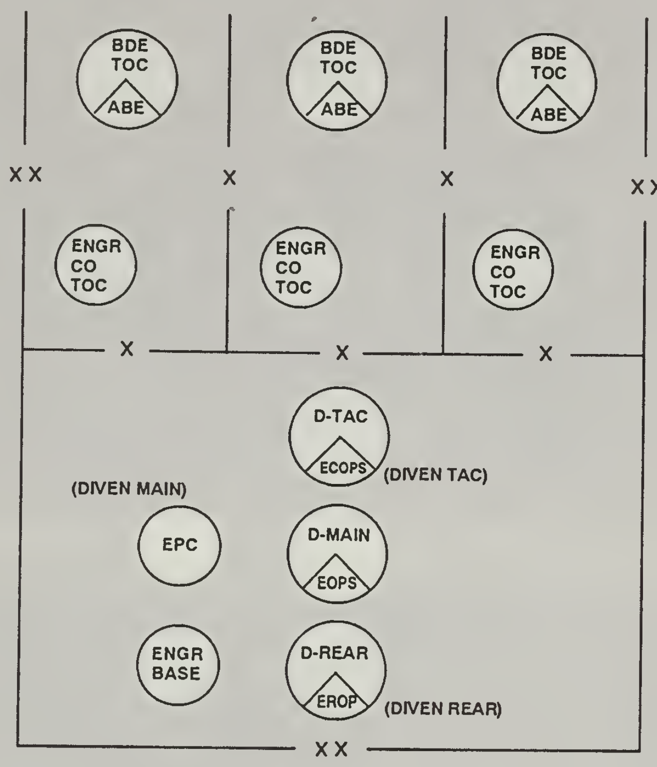
Division Forward Area

Habitually associated divisional engineer companies support each infantry brigade. An assistant brigade engineer (ABE) from the company operates an engineer cell in the brigade TOC (Figure 3). The company establishes a TOC near the brigade support area, which focuses on sustaining engineers operating in the brigade area. The company commander is free to position himself wherever he can best advise the maneuver brigade commander and control engineers operating in the brigade area.

Divisional engineer platoon leaders serve as battalion task force engineers while assigned to a specific task force. There are only two engineer platoons in the light division engineer company, so all battalion task forces may not have a task force engineer. The ABE cell serves as the central engineer information and control node for all engineer effort in the brigade.

The engineer close operations cell (DIVEN TAC) in the DTAC is manned continuously by the ADE, LNO or a battalion S-3 NCO to keep

Light Engineer C^2 Laydown



ABE = Assistant brigade engineer
ECOPS = Engineer close operations cell (DIVEN TAC)
EOPS = Engineer operations cell
EPC = Engineer plans cell (DIVEN MAIN)
EROP = Engineer rear operations cell (DIVEN REAR)

Figure 2

Assistant Brigade Engineer (ABE) Cell

Principal members:

- Company commander (as required)
- Assistant brigade engineer (OIC)
- NCO assistant

Primary functions:

- Track current brigade engineer operations
- Pass information between all engineers in brigade area and the EOPS
- Integrate engineers into plans for future operations; conduct engineer planning and write engineer annexes
- Maintain an engineer data base
- Serve as a central contact point for all units in the brigade area to request engineer information or assistance

Secondary functions:

- Alternate company CP
- Coordinate engineer intelligence
- Track war stopper sustainment issues

Location:

- In brigade main TOC

Figure 3

Engineer Close Operations Cell
(DIVEN TAC)

Principal members:

- Division engineer (as required)
- ADE/Battalion S-3 (as required)
- ADE LNO (OIC)
- S-3 NCO

Primary functions:

- Take control of the engineer battle from the engineer operations cell
- Integrate engineers into close operations
- Maintain an engineer data base
- Serve as a central point to request engineer information or assistance
- Relay information to the engineer operations cell

Secondary functions:

- Track close and deep battle
- Anticipate engineer changes

Location:

- In DTAC

Figure 4

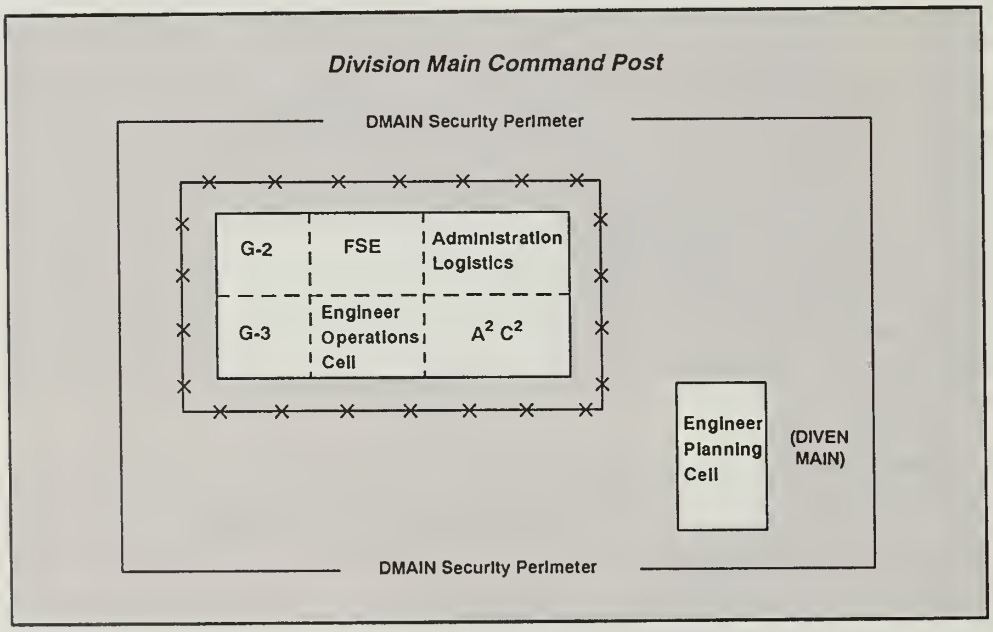


Figure 5

it ready to assume control of close engineer operations. When the DTAC is in control of the battle, the DMAIN engineer cells augment this engineer cell to control the close engineer battle (Figure 4).

Two engineer cells operate within the DMAIN perimeter: the engineer operations cell and the engineer plans cell. The battalion S-3 and ADE provide 24-hour field grade engineer officer coverage for both engineer cells in the DMAIN area. The division engineer is free to position himself wherever he can best advise the division commander and control all engineer effort in the division area (Figure 5).

The engineer operations cell controls all engineer effort in the division area of operation, with G-3 oversight. Two battle captains and two battle NCOs, staffed from the battalion ADE and S-3 sections, provide 24-hour coverage for controlling the current engineer battle. This cell directs effort and tasks engineer units through brigade engineers in the forward brigade areas and through the rear operations cell for units operating in the division rear. The operations cell also coordinates corps engineer augmentation. In addition, it provides an engineer command and control element for an engineer task force or a special operation (Figure 6).

The engineer operations cell receives current operations reports from brigade engineers and the engineer rear operations cell. Corps augmentation units normally report to a brigade engineer or the rear engineer, depending on where the units are located on the battlefield.

Critical information is disseminated to engineer cells in the division tactical and rear command posts, as well as the engineer plans cell (DIVEN MAIN). Personnel from the engineer operations cell present situational updates at each of the division briefings and submit required reports to higher engineer headquarters.

An engineer plans cell (DIVEN MAIN) at the DMAIN serves as an area for the development of future operations. It is located "outside of the wire," but within the security perimeter of the division command post. The battalion S-2, communications, and NBC sections operate from this location. It sends couriers to the brigade and division tactical operations centers as required.

Each non-divisional battalion and separate engineer company working in the division area provides a liaison who operates from the engineer plans cell (DIVEN MAIN). This cell serves as a meeting place for engineer coordination and planning. The division engineer conducts daily updates and planning meetings at this location (Figure 7).

This command and control structure normally allows continuous field grade coverage in the vicinity of the DMAIN. The ADE and battalion S-3 are able to oversee both operations and planning. They also serve, with the division battle staff, as part of the operational planning group in conjunction with the G-3 plans cell. If required, one of these two majors can be released to command a separate engineer task force in support of the division.

Division Rear Area

An engineer rear operations cell in the DREAR CP monitors sustainment for engineers working within the whole division area, coordinates missions in the rear area, and manages all engineers operating in the division rear area. The divisional engineer battalion executive officer is the rear engineer who advises the assistant division commander for support. The battalion S-1 section, the battalion maintenance officer, and an S-4 representative support him. The battalion's administration and logistics operations center (ALOC) is collocated with the DREAR (Figure 8, page 12).

Engineer Operations Cell

Principal members:

- Division engineer (as required)
- ADE/Battalion S-3
- Assistant S-3s
- Selected S-3/ADE enlisted staff

Primary functions:

- Command organic and attached engineer assets
- Control all engineer assets within the division
- Synchronize and coordinate current engineer operations
- Maintain engineer data base
- Request engineer augmentation
- Troubleshoot logistic support to divisional engineers
- Obtain mission logistics for augmenting engineering
- Serve as a central contact point for engineer information and requests

Secondary function:

- Provide engineer input to future division plans

Figure 6

Engineer Plans Cell (DIVEN MAIN)

Principal memebers:

- Division engineer (as required)
- ADE/Battalion S-3 (as required)
- Battalion S-2 (OIC)
- Selected S-2/S-3 enlisted staff
- Battalion Commo Section
- LNOs

Primary functions:

- Integrate engineers into plans for future operations
- Prepare engineer estimates, OPORDS and annexes
- Coordinate IBP with G-2
- Monitor and disseminate NBC information
- Serve as engineer meeting and coordination location

Secondary functions:

- Augment engineers operations cell
- Augment engineer task force headquarters
- Control or monitor special engineer operations or problems

Location:

- Vicinity DMAIN

Figure 7

The engineer rear operations cell (DIVEN REAR) develops requirements for support and coordinates priorities of effort through the engineer operations cell. Within these priorities, the rear engineer directs engineer effort in the rear area.

The DIVEN REAR continuously monitors and coordinates with other division rear elements to protect critical assets, maintain mobility, and assist with area damage control. This cell monitors friendly and enemy obstacles, tracks engineer logistical problems, and coordinates sustainment for the divisional engineer battalion. It also serves as the alternate engineer operation cell, should the DMAIN become combat-ineffective.

An engineer base is usually separate from the DREAR CP. The engineer base executes sustainment functions for engineer units in the division area. Non-divisional engineers operating in the division can collocate here to maximize efficient sustainment support. This also facilitates engineer integration into the division's rear area security structure. The divisional HHC commander is in charge of the engineer base unless a larger engineer headquarters is available for an extended period of time. Elements of the divisional battalion S-1 and S-4 augment the HHC (Figure 9, page 13).

Engineer Rear Operations Cell
(DIVEN REAR)

Principal members:

- Battalion executive officer
- Battalion S-1
- Battalion maintenance officer
- S-1 staff
- S-4 NCO

Primary functions:

- Integrate engineers into rear operations
- Coordinate and assign missions to engineers operating in the division rear area
- Plan engineer logistical requirements
- Monitor sustainment of all engineers in the division area for all classes of supply
- Coordinate sustainment for divisional engineers
- Coordinate solutions to maintenance and logistical war stoppers
- Maintain engineer data
- Serve as a central contact point for engineer information and requests
- Assist with area damage control

Secondary functions:

- Serve as alternate engineer operations cell
- Provide sustainment support

Location:

- In DREAR

Figure 8

Training Exercises

The 41st Engineer Battalion has conducted several training events to test this new command and control initiative and refine its structure. Early in the development of the initiative, battalion-level communications exercises were used to resolve personnel and equipment issues. Later, the system was fielded as part of several battalion- and division-level command post exercises.

To date, the most successful application of this command and control arrangement was during the conduct of the battalion's external evaluation. The 326th Engineer Battalion (AASLT) conducted an EXEVAL of the 41st in October 1991, and the results were favorable. The Fort Campbell evaluators offered constructive comments which have aided the development of this command and control method.

Recently, the 10th Mountain Division attended a workshop seminar for the Battle Command Training Program (BCTP), at Fort Leavenworth. The battalion commander, ADE, and S-3 attended this seminar under the new command and control structure.

Discussion

Implementation of the light engineer command and control initiative has revealed several advantages:

- *Better staffing of engineer operations.* Consolidated assets from the division engineer battalion staff sections are organized to provide responsive cells at critical points on the battlefield.
- *Increased parallel planning.* Collocation of the battalion and division staffs allow for better information flow. For example, the battalion S-2 can fully integrate with the division G-2, participate in the IPB process, and have access to timely intelligence information.
- *Streamlined engineer reporting and control.* Communications and information no longer need to be channeled through an engineer battalion TOC to the division engineer section. This precludes the duplication of reports and plans.
- *Engineer personnel and vehicles available for coordination and support.* The consolidation of divisional engineer elements provides staff robustness and frees vehicles to conduct reconnaissance, coordination, and courier missions.
- *Increased security.* Protection of engineer command and control is enhanced by integrating engineer elements into the security of the division command post, and by establishing a consolidated engineer base.
- *Improved engineer information accessibility.* The engineer cells in brigade TOCs, the DTAC, DMAIN, and DREAR serve as nodes, providing ready access to engineer information and resources throughout the division area.

The major disadvantage of this structure is the increased signature of the division command posts. Some flexibility is also lost by allocating engineer command and control assets to the different nodes of the division command post structure. The destruction of a divisional command node would mean the loss of the associated engineer cell.

Engineer Base Cell

Principal members:

- HHC commander (OIC)
- HHC XO/Equipment platoon leader
- HHC 1SG
- HHC staff
- Battalion maintenance
- Battalion mess team
- Battalion S-4
- Battalion S-4 staff

Primary functions:

- Sustain the battalion
- Coordinate area security

Location:

- New division support area or major engineer project

Figure 9

Conclusion

Reorganizing light engineer command and control assets to direct effort from a divisional perspective provides more efficient and responsive support. The division engineer controls effort centrally, but executes operations in a decentralized manner through his various cells.

Engineer elements operating in the division forward area are controlled by—and report directly to—the operations cell in the DMAIN. Engineer units working in the division rear receive direction through the engineer rear operations cell (DIVEN REAR) in the DREAR. Direct links between these cells and the division and brigade command posts provide the maneuver commander with a more responsive engineer force and access to timely information.

Major Allen is the executive officer of the 41st Engineer Battalion. He previously served as assistant division engineer for the 10th Mountain Division. Other assignments include group engineer for the 10th Special Forces Group, S-3 of the 23rd Engineer Battalion, and company commander for the 23rd. He is a graduate of Command and General Staff College, and holds a master's degree in administration from Central Michigan University. He earned his bachelor's degree from the University of Florida.

Major Whiteman is S-3 of the 41st Engineer Battalion. Other assignments include assistant professor of civil and mechanical engineering at West Point, company commander for the 2nd Engineer Battalion, and S-4 for the 76th Engineer Battalion. He is a graduate of Command and General Staff College, and holds a master's degree in civil engineering from Massachusetts Institute of Technology. He is a West Point graduate.

Book Review

***Anatomy of Courage*, by Lord Moran, Garden City Park, New York: Avery Publishing Group, Inc., 1987, 202 p.**

World War I was unlike any conflict that came before it or has happened since. It was a meeting of 19th century ideas and attitudes toward war and its waging, and emerging 20th century technology. This union produced a battlefield of destruction which affected every individual who came in contact with it. Lord Moran, a medical officer with England's First Battalion of the Royal Fusiliers, kept diaries that contained his observations on how that war affected the men charged with its execution, both officers and enlisted. During World War II, as Winston Churchill's personal physician, he observed other facets of warfare at both the level of the soldier and the statesman. First published in 1944, his book, *The Anatomy of Courage* has been republished as part of Avery's Art of Command Series.

Lord Moran's purpose was "to find how courage was born and how it was sustained in a modern army of a free people." This was important because, "the soldier is alone in his war with terror and we have to recognize the first signs of defeat that we may come in time to his rescue."

Using his diaries, Moran tells many stories that illustrate the discovery of fear, how courage is spent, and the care and management of fear. Later he discusses discipline and leadership. The stories reflect Moran's keen insight and sensitivity to the shattering affect that the trenches had on his battalion. In this he did not write as an impersonal third party; his own fears and beliefs are offered as well.

For Moran, courage was a moral quality. It was willpower, the fixed resolve not to quit. In the trenches, Moran said, a man's willpower was his capital, and he was always spending. Moran believed that leaders were obligated to watch "the expenditure of every penny lest their men went bankrupt. When their capital was done, they were finished."

He also believed it was possible to add to the account, and used examples of fighter and bomber pilots during World War II to demonstrate the need for both physical and mental rest. He noted, however, that a man who spent too much time away from combat was likely never to return. For such soldiers, life became more important than their commitment to fellow soldiers or their country.

Writing with an obvious pride in his countrymen, Moran compared the professional soldier and the citizen soldier, especially with respect to discipline. He saw the change in the nature of armies in the two wars, and the successes and failures of discipline in both. For Moran, a man's personal discipline was as important as that imposed by commanders.

Moran believed that a soldier's commitment to his regiment and the leadership of his officers were important supports in the sustainment of courage and the fight against fear. He defined leadership as the capacity to frame plans that would succeed and the faculty of persuading others to carry them out in the face of death. Success, or the expectation of success was crucial; it justified the terror, sacrifices, and pain of battle. In some instances, success was due more to a commander's knowledge of what his men could do, rather than what they were supposed to do. In this respect, "the art of command is the art of dealing with human nature."

In our doctrine today, leaders are obligated to know war and its affect on soldiers. Outside of actual battle, we can understand the human dimension of war only by reading about past conflicts. Without this understanding, leaders cannot hope to effectively train soldiers for the demands of combat. Thus, Moran's book will be useful to leaders training their soldiers for battle. In this regard, the writings of Frederick the Great are still valid. "Unless every man is trained beforehand in peacetime for that which he will have to accomplish in war, one has nothing but people who bear the name of a business without knowing how to practice it."

Dr. Larry D. Roberts, Command Historian, U.S. Army Engineer Center.

Float Bridge Training

Article and photos by Phil Howell

There's a small lake, tucked into a remote corner of Fort Leonard Wood, that wears two faces. In the early morning, it looks like the kind of man-made pond you'd find on the best golf courses. A serene place, with pristine water, manicured shores, and a beautiful valley setting that would be the envy of any land developer. Songbirds search the waterline for insects, squirrels chatter in the nearby trees, and all is at peace with the world.

Then all hell breaks loose.

Five boats, painted military drab and weighing 4 tons each, are launched onto the water. Almost immediately, the calm is shattered by the roar of dual, 200 horsepower diesel engines firing up in each craft. Pulling away from the dock for their test runs, they turn the smooth surface of the lake into a scene from hurricane news footage, sending waves crashing onto the shore.

Helmeted troops hustle along the water's edge, guiding heavy trucks as they back slowly into the lake. Stopping about 10 feet out in shallow water, the trucks whine and creak as their motorized carriages tilt back to unload their cargo onto the lake surface. Each truck carries what looks, at first, like a giant, camouflaged loaf of

Photo opposite page: Combat engineers (12B) and bridge crewmen (12C) lift an aluminum balk into the roadway of an M4T6 float bridge. Building the bridge is part of the 5-day Float Bridging Course at Fort Leonard Wood.

"When they arrive at their unit, we want our students to be an immediate asset to the bridge-building effort."

Students, assisted by an instructor, unload a ribbon bridge bay into "Lake TA250" from a bridge transporter truck.

bread. But after being dropped in the water and released from its cable, the loaf—like some monster Transformer toy—unfolds into what appears to be a floating slice of interstate highway.

Untypical training, maybe. But a typical day in the Float Bridging Course at Fort Leonard Wood, the Army's only entry-level float bridge training facility for both Active and Reserve Component forces.

Located at Training Area 250, the course is run by 12 instructors and 22 support personnel from Bravo Company, 589th Engineer Battalion. Over 3,000 soldiers a year are trained at the site in the fundamentals of the ribbon bridge, the M4T6 float bridge, the M4T6 fixed bridge, and bridge transporters.

Soldiers attending the course include initial entry trainees with a 12B (Combat Engineer) or 12C (Bridge Crewman) MOS, BNCOC (Basic NCO Course) students, EOBC (Engineer Officer Basic Course) students, Reserve and National Guard personnel, permanent party soldiers, and foreign military personnel.

Located next to Missouri's Big Piney River, the TA250 site covers 38 acres, and was completed in June 1986, with the construction of the new man-made lake. Ribbon bridge training takes place on the lake; M4T6 float bridge construction is done on the Big Piney, and M4T6 fixed bridge training is conducted on earth-and-concrete sites designed specifically for the fixed bridging.

The course runs for five days, and is divided into the following blocks for initial entry trainees and other students needing the full familiarization course:

- Ribbon bridge — 30.5 hours
- M4T6 float — 7.5 hours
- M4T6 fixed — 7 hours
- Driver's training — 8 hours

Training times vary for other groups, depending on the needs expressed by their parent units.

While the M4T6 is no longer actively used in engineer units, and bridge stocks are kept in storage for possible wartime needs, the course teaches students the fundamentals of its construction.

"The ribbon bridge replaced the old MAB (mobile assault bridge) and the M4T6 float as our primary assault bridges," said Sergeant First Class William Simmons, chief instructor for the course. "But since the M4T6 may be called into service as a follow-on bridge for supply trains, we still need to teach soldiers how to put it up."

The M4T6 is a jigsaw puzzle of a bridge. A giant erector set, with too many interlocking pieces that fit too close together. Sometimes, when parts are not exactly aligned, a sledge-hammer has to be used to nudge reluctant aluminum beams into position. On average, it takes a student class 3 and one-half hours to erect about 40 feet of M4T6 over the Big Piney River (a full bridge is not constructed to avoid blocking river craft).

In a real-world bridging scenario, when M4T6 floats were still being used in daily operations, it would take about 3 and three-quarter hours for a bridge unit to put up a Class 70-75 bridge having 53 feet of useable load space. And it would take the following assets—in addition to bridge parts—to do it:

- 60 men
- 3 separate assembly sites
- Air compressor
- Crane (20-ton minimum)
- 2 bridge erection boats
- 7 bridge trucks

In contrast, soldiers using ribbon bridging can construct a Class 70-75 float bridge with 88 feet of load space in *20 minutes*. Required assets include:

- 16 men
- 2 bridge erection boats
- 6 ribbon bays
- 8 bridge transporter trucks

Speed and ease of construction don't limit the capabilities of the bridge, either. The ribbon bridge can transport anything from M1 tanks to jeeps across water.

Staff Sergeant Joannes Kan, left, a course instructor, teaches proper hand signals to a student during recovery operations for ribbon bridge bays.

To prove that, and as a follow-on to the 5-day course, students participate in a 24-hour combined arms training exercise (CATEX). During the exercise, they're required to construct a ribbon bridge during both day and night conditions. They must then successfully transport tanks, armored personnel carriers, heavy trucks, and other vehicles across "Lake TA250."

While the water isn't clear enough to see to the bottom, Sergeant First Class Joe Hawk, the TA250 site chief, assured me that they "haven't lost any vehicles yet." In fact, the site has an excellent safety record, with no deaths, serious injuries, or lost vehicles since it opened.

Instructors for the course are dedicated, a fact made obvious by the way they interact with the students. There is no harassment and no impatience. Questions and mistakes are dealt with in the same manner: thorough explanation and demonstration of the proper technique.

But there is also no nonsense. Putting up an assault float bridge is serious business. Both for what it means to the combined arms mission, and in terms of potential danger to the engineer soldiers. The instructors know their job. And they've all been where their students are going.

"When they arrive at their unit, we want our students to be an immediate asset to the bridge-building effort," said Simmons, a 19-year veteran of bridging. "We want to give them a solid foundation of knowledge in the equipment they'll be using, so they can have confidence in what they're doing."

> **"...at the end of the five days, the results of the quality instruction at the site were obvious."**

Training at TA250 is normally conducted at skill level 10. Soldiers receive more extensive, on-the-job training once they arrive in their units.

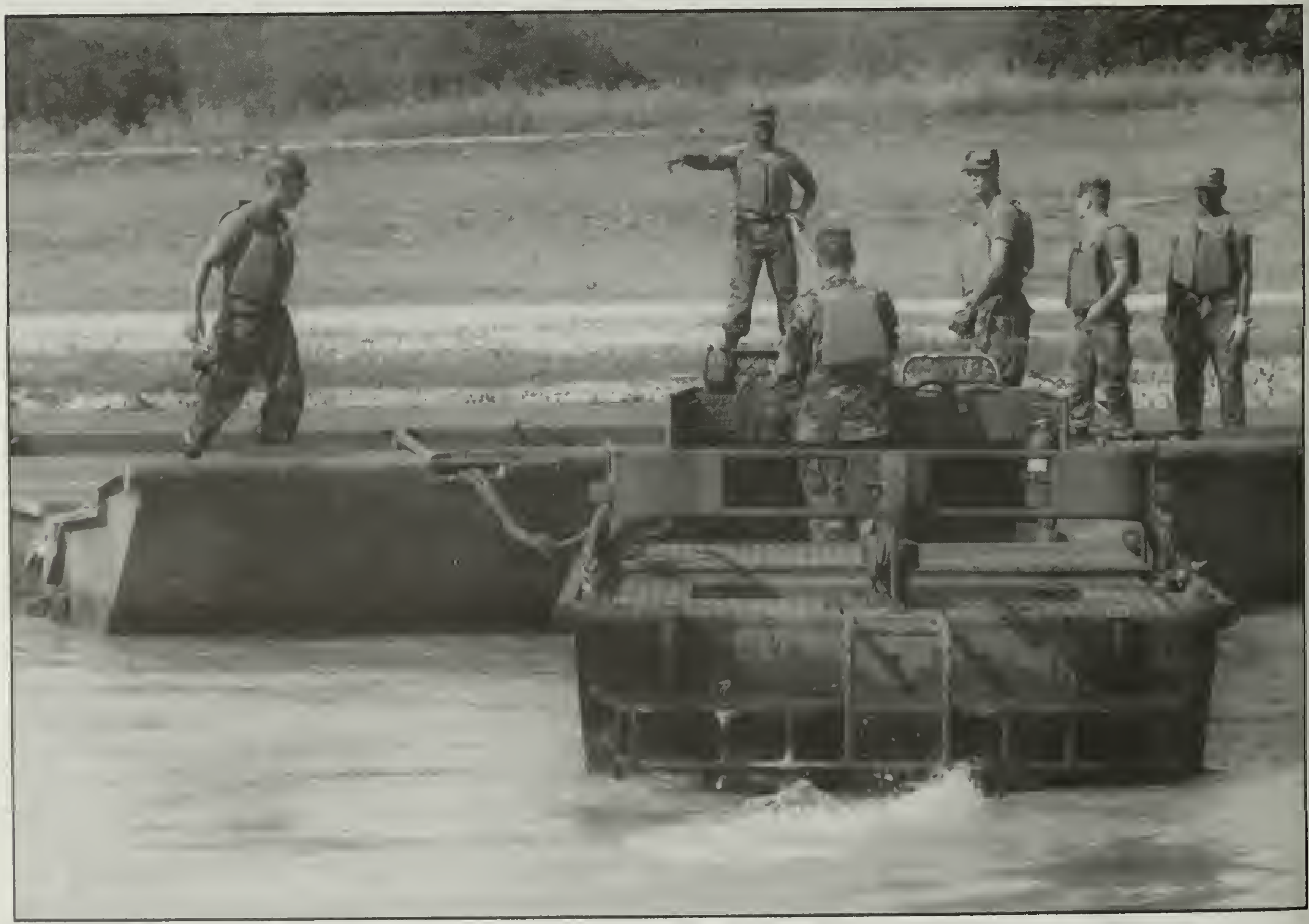
"We have the most knowledgeable instructors in the Army," said Simmons. And the Army seems to think so, too. TA250 instructors were recently chosen to travel to Aberdeen Proving Ground, Maryland, to test the Army's improved float bridge.

Once the bridge is fielded, those same instructors will be the ones to teach other bridging engineers how to use it.

"We've got quality people," said Sergeant First Class Willie Gee, Bravo Company's Bridge Branch Chief. "They've been there. They know the difficulties, the hazards. Most importantly, they know the right way to build a bridge. And we do a good job of instilling that knowledge in the students that come through the course."

Standing back and watching assault bridging operations is kind of like watching tennis players compete at Wimbledon—it looks easy when *you're* not the one running after the ball.

But when you're working with



Using a bridge erection boat, an instructor maneuvers a ribbon bridge bay into position for connection to another bay. Students assist by placing connecting lines, and locking down connectors.

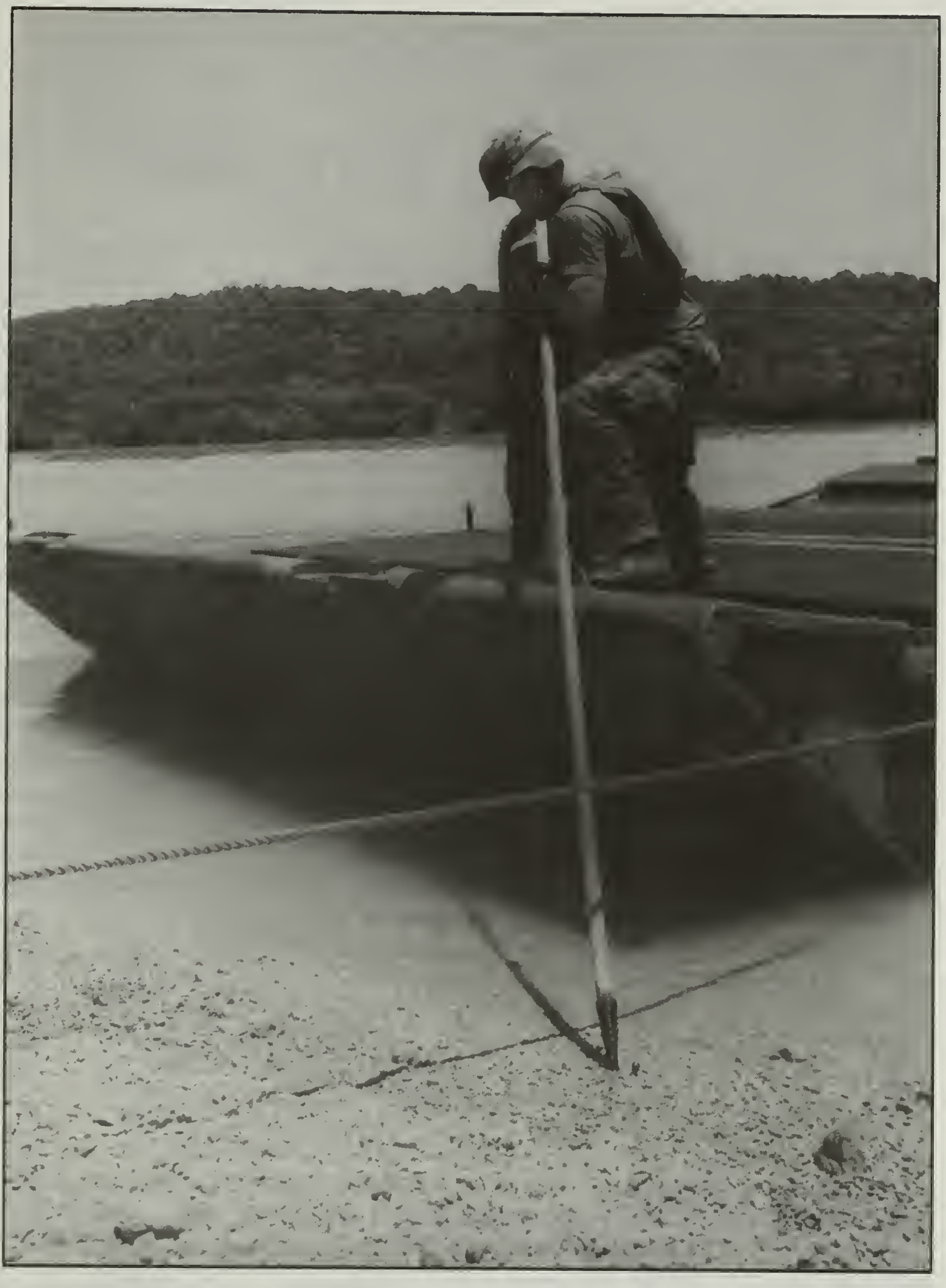
tons of steel and aluminum, unstable bank conditions, bad weather, fast/deep/cold water, impatient maneuver commanders—and then throw in a little extra tension from a fast-paced tactical training exercise or even combat—and it's a whole different ball game. The idea at TA250 is to give the students the knowledge they need to build good float bridges, and move men and materials over them. They'll learn to wrestle all those other alligators later.

At the beginning of the five-day course I attended, students were nervous, unsure, or—perhaps worse—overconfident. The conversion of under- or over-confident students into knowledgeable, apprentice bridge builders is not an easy task, but one that the instructors seem to genuinely enjoy.

Through initial driver's training on the bridge transporter trucks, familiarization with the bridge erection boats, and then instruction on the bridges themselves, you could see student attitudes becoming more even, more wrinkle-free. Leery students took on a new confidence and pride in their rapidly expanding abilities with the equipment and techniques. Those that may have thought bridging was "easy" were brought down (gently) a notch or two.

But at the end of the five days, the results of the quality instruction at the site were obvious. Without exception, the students were on sure footing when it came to knowing what they were taught during the course.

As one young bridge crewman said to me, "You know, I know I'm not an expert on this stuff. But thanks to the people here, I know I'm going to get there."



Using a boat hook, a student pushes off a ribbon bridge bay from shore during a bay connection class.

Mr. Howell is the features editor for Engineer Professional Bulletin. An Army Reserve major, he also serves as a senior writer-instructor for the Engineer School. Active duty assignments include editor-in-chief of Special Warfare magazine and public affairs officer for the John F. Kennedy Special Warfare Center, company commander for the 1st Special Operations Command, radio and television broadcasting officer for the 4th Psychological Operations Group, and public affairs officer for the 5th Infantry Division. He is a graduate of Eastern New Mexico University.

The "I Wonder" Years

By Captain David A. Kramer

There was a time not long ago when almost all West Point, ROTC, and OCS cadets who performed well in their pre-commissioning training were brought on active duty if they so desired. It seemed like such a logical process: the cadet wants an active duty career; the cadet does well in school, and the cadet demonstrates leadership potential—therefore, the cadet gets an active duty career.

This logic held true as recently as two years ago when roughly 60 percent of cadets who applied for active duty were selected. This past year, however, saw a drastic reduction in that number. Only 2,194 cadets were selected out of 4,867 who asked for active duty—a selection rate of about 45 percent. Of the 262 engineer officers fortunate enough to be selected, only 166 were actually brought on active duty last year. The remaining 96 officers had to wait until this fiscal year to report to the Engineer Officer Basic Course.

Fiscal Year 91 marked the Army's transition into a new era; one that I like to call the "I Wonder" years. Uncertainty about the Army's strength level and structure is the only thing today's officers can be certain of. Reduced active duty accessions is just one of many changes affecting the way company grade officers look at—and plan for—their Army careers.

The reality of a force drawdown, along with the Engineer Restructure Initiative (ERI), has placed new demands on young lieutenants. They must quickly come to grips with operational assignments, institutional and self development, and branch qualification in order to lay the groundwork for successfully managing their careers.

The new engineer force is already emerging. Fewer, smaller, CONUS-based units will be performing broadened missions with decreased resources. As a result, tour lengths will be carefully controlled, fewer key positions will be locked in, and there will be an increased reliance on officers proficient in several concentration and functional areas.

In order to be successful, officers must be actively involved in the assignment process to get the right job at the right time. This should not be translated as "ticket punching," but as personal career management. Lieutenants who chart a logical career course from the outset will be successful during the intensely competitive company grade years. This will enable them to move on to greater opportunities later in their career.

Exercises like COBRA GOLD in central Thailand provide opportunities for platoon leaders to do combat construction work with engineers from other armies.

Development vs. Qualification

Regardless of an officer's future career path, be it command, staff or functional area, there are several assignments that form the foundation for success as a combat arms officer. These important, career-making jobs may be classified either as branch development (operational assignments which aid in the professional growth of an officer), or branch qualification (assignments which must be satisfactorily completed at each career level in order to be considered for retention or promotion).

The debate over which assignments are developmental and which are qualifying will not end soon. Engineers, however, continue to maintain that an officer is branch qualified upon successful completion of EOBC, EOAC, and company command. Beyond the basic branch qualification at company grade level, there are presently no further qualification requirements within the engineers. Rather, an officer rises sequentially through positions of increasing responsibility, commensurate with the officer's quality of performance. However, the possibility of establishing field grade qualification standards in the future is a topic of discussion within the Department of the Army.

Lieutenant Time

As a lieutenant, the engineer officer must become technically and tactically proficient. The lieutenant's goal should be to get leadership experience. It is important to spend as much time as possible with engineer units as a platoon leader and executive officer. The officer will gain first-hand knowledge of the complex combined arms battlefield and better understand his role in providing support to the maneuver commander.

More importantly, the officer will get practical experience in leading and training soldiers. While generally performing duties with combat and topographic engineers, it's beneficial for lieutenants to serve with other types of units. With a variety of assignments, the officer can attain the broad base of experience engineer leaders require.

A light engineer platoon leader communicates with helicopter support during a landing zone operation on the island of Oahu.

Over the next few years the opportunities for platoon leader assignments will swing toward the divisional side with the activation of eight new ERI heavy divisional battalions. The 60 additional engineer platoons will be offset by a reduction of about 75 platoons from corps battalions, 12 from light battalions, and 27 from combat heavy battalions. Airborne, air assault, bridge, and topographic platoon opportunities remain essentially unchanged.

When the drop in the number of platoons is considered in light of the lieutenant population reduction, the actual opportunity for platoon leader assignments increases by about 25 percent. Lieutenants will be able to spend more time in leadership positions that prepare them for all future assignments.

Retention Time

Manner of performance during an officer's first three years will be critical at the Lieutenant Retention Board. Previously known as the CVI/RA Board, it's objective is to size the year groups so that the promotion opportunity to captain is about 95 percent. Without a retention board, year groups would have to undergo a reduction in force (RIF) as captains—prior to consideration for promotion to major. These boards will be held for year groups 89 and 90, but will not be required after FY 93 because adjusted accessions over the next two years will sustain the projected force.

Emphasis will continue to be placed on the Voluntary Early Release/Retirement Program (VERRP) as a tool to downsize the force. In FY 90, 445 lieutenants and 36 captains were approved for separation. Of those officers, 37 percent were from the United States Military Academy, 56 percent from the Reserve Officer Training Corps, and 7 percent from Officer Candidate School. Of the 824 requests considered by this year's board, 65 were engineers (41 USMA, 21 ROTC, and 3 OCS) and all were approved. While this board serves the

Army's purpose well, it is also the best time for an officer to make the decision to leave active duty.

Captain Time

Attendance at the Officer Advanced Course will prepare lieutenants and captains for that all-important company command assignment. As the final step for branch qualification, all engineer officers should actively seek command and perform well—regardless of the type of unit.

The performance of an officer while in command is viewed as the most critical factor in demonstrating potential for future positions of additional responsibility. It is, therefore, directly related to promotion and retention.

Like platoon leader positions, the opportunity to command a unit is expected to increase about 11 percent over the next five years. Because of the addition of 20 ERI heavy divisional companies and several combat support equipment companies, the loss of 57 corps and combat heavy companies is not nearly as drastic as the approximately 28 percent reduction in personnel competing for the assignments.

The Functional Area Puzzle

During the fifth year of active service, all officers request designation of a functional area. Depending on Army requirements, some engineer officers may single-track in the engineer branch. The three areas of concentration, 21B, 21C, and 21D, permit adequate assignment flexibility to accommodate single-tracking.

For years, engineer captains were told that single-tracking was the path to success. The branch goal was to have 60 percent of any year group single-track and, in fact, last year over 60 percent of Year Group 85 requested and were designated single track 21.

This year, however, saw the philosophy regarding functional area designation take a major turn. A trend has been established to reduce the number of single-track engineers. This will result in the branch asking that at least 60 percent of each year group be dual-tracked by FY 95.

As previously stated, the smaller Army of the future will place greater emphasis on joint and functional area experience with fewer pure 21C and 21D positions. Although reduced, the opportunities in topographic, DEH, and district engineer positions will continue to provide single-tracked officers the diversity of assignments necessary for career development.

In general, however, engineer officers should look toward the functional areas to provide the broadening opportunities for them to meet the Army's career development goals. By his fifth year, every engineer captain must assess his previous academic and engineer experience and consider his future utility to the Army in order to correctly solve the functional area puzzle.

Retention Time Revisited

Just when most engineer officers start feeling comfortable—when they've completed command and crossed the functional area threshold—the potential for elimination rears its ugly head again. The Army must meet its mandated end strength, and to do it without a smart strategy would be disastrous. That strategy is being developed and the unpleasant task of executing it lies ahead.

In addition to the selective early retirement of many field grade officers, it is inevitable that the population of Year Groups 81 through 86 must be reduced further. Whether the reduction occurs with a RIF prior to the major's selection board, or as a result of low selection rates on the board, the outcome is the same. These year groups must be sized correctly in order to maintain a healthy career progression pyramid. While emphasis is being placed on maximizing voluntary separations, involuntary cuts will still be made at all levels—and not just for company grade officers.

The Bottom Line

Engineer lieutenants and captains can be enthusiastic about the future if they've sought tough assignments, demonstrated excellent performance in those assignments, and actively participated in personal career management. Post-company grade life has no specified tracks to follow, only different career development assignments. The opportunities for field grade positions with troops and other equally demanding and rewarding jobs should increase over the next five years at rates similar to those for platoon leaders and company commanders.

Schools, promotions, and command selection for all branch-qualified officers is based on performance in each job assignment, not on rigid qualification gates in predetermined paths. Despite the uncertainty that pervades today's Army, quality officers will still be able to progress through varied assignments, have successful careers, get promoted, and be contributing members of the force. The bottom line for success will continue to be performance.

Captain Kramer is currently assigned to the Kuwait Projects Office, Transatlantic Division, U.S. Army Corps of Engineers. He previously served as officer specialties coordinator for the Engineer School's Engineer Personnel Proponency Office. He has also served as a company commander in the 31st Engineer Battalion, civil engineer and project manager for the U.S. Army Engineer District in Buffalo, New York, and as platoon leader with the 79th Engineer Battalion. He is a graduate of the Engineer Officers Advanced Course, the Combined Arms and Services Staff School, and holds a degree in civil engineering from Pennsylvania State University.

Engineers Fight As Infantry!

By Captain Peter G. Laky

Engineers rarely appreciate the importance of their infantry training. Field Manual 5-100 states that combat engineers have a secondary mission to fight as infantry. It paints in dramatic terms the risks to the maneuver commander of jeopardizing his engineers, and concludes that engineers usually will employ infantry tactics only as required to complete combat engineer missions. My experience in the Gulf War, however, taught me that our secondary mission is not so remote. Because of the speeds at which we maneuver and move logistics about the non-linear AirLand Battlefield, combat engineer units are more likely than ever before to receive infantry missions.

I believe we need to reassess the importance of close combat skills in engineer doctrine and unit training programs. To test proficiency, I recommend that combat engineer companies and Engineer Restructure Initiative battalions be trained and observed on at least one infantry mission during each combat training center rotation. Based on my experience, I believe it's time to re-evaluate the combat engineers' role as infantry in combined arms operations.

Desert Organization. The 5th Engineer Battalion supported the 1st Brigade, 24th Infantry Division (mechanized) during Desert Shield/Storm. My company spent months integrating into an infantry battalion task force, conducting combined arms breach training and live fire training. Prior to combat, the brigade organization was changed to four engineer companies (three wheeled, one mechanized) to support three maneuver task forces. My company was designated as a brigade asset.

After the war started, however, we were given infantry missions, in turn, to dig in on-line with infantry in a defensive battle position, to provide a reaction security force to brigade and division trains, and to conduct mounted and dismounted security patrols for the brigade tactical command post (TAC) during an attack into the Euphrates River Valley and Basra.

Mission 1 - Perimeter Defense. The first mission arose from a threat to division aviation elements when the 24th Infantry Division deployed from central Saudi assembly areas to the Iraqi border. Due to a shortage of heavy equipment transporters, the 24th Aviation Brigade preceded the mechanized brigades. Iraqis suddenly began mortaring Saudi border stations during the deployment, which led to the first shooting contact between U.S. and Iraqi forces.

Concerned for the security of aviation assets, the division commander deployed that part of an infantry task force movable with organic trucks and my entire wheeled engineer company. We quickly established a defensive perimeter around the helicopter companies. A platoon from our engineer company was formally reorganized as infantry and attached to the infantry task force.

They dug in with M60 machine guns, M67 rocket launchers, borrowed SAWs, M203 rocket launchers, and a mortar fire plan. Using a plan straight out of the Engineer Officer Basic Course primer, the platoon leader tied in his fire plan with infantry dismounts on the left and dismounted TOW launchers on the right. He then conducted observation post drills and patrols while the enemy remained across the border.

Mission 2 - Tactical Response Force. The second mission was done in conjunction with a route marking mission for the brigade and division trains. We were to protect the forward support battalion and other support elements from levels I and II threats, enemy squads, platoons and companies, until mechanized infantry could provide additional support if required. Maneuver forces had been instructed not to hold up the advance for anything less than a full enemy platoon. My platoons spent many days and nights rehearsing mounted and dismounted movement to contact and the rapid preparation of a dismounted blocking position.

During the attack into Iraq, one of my platoons cleared a bunker complex at night. The NCOs in this platoon later reported that their infantry training was inadequate to prepare the squads for the harrowing experience of maneuvering in darkness through a honeycomb of bunkers and holes. They were well armed with AT-4s, bunker busters, grenades, and

(Continued on page 34)

Remarks By Gen. Gordon R. Sullivan, Army Chief of Staff

To the Senior Engineer Leader Training Conference
Fort Leonard Wood, Missouri
April 23, 1992

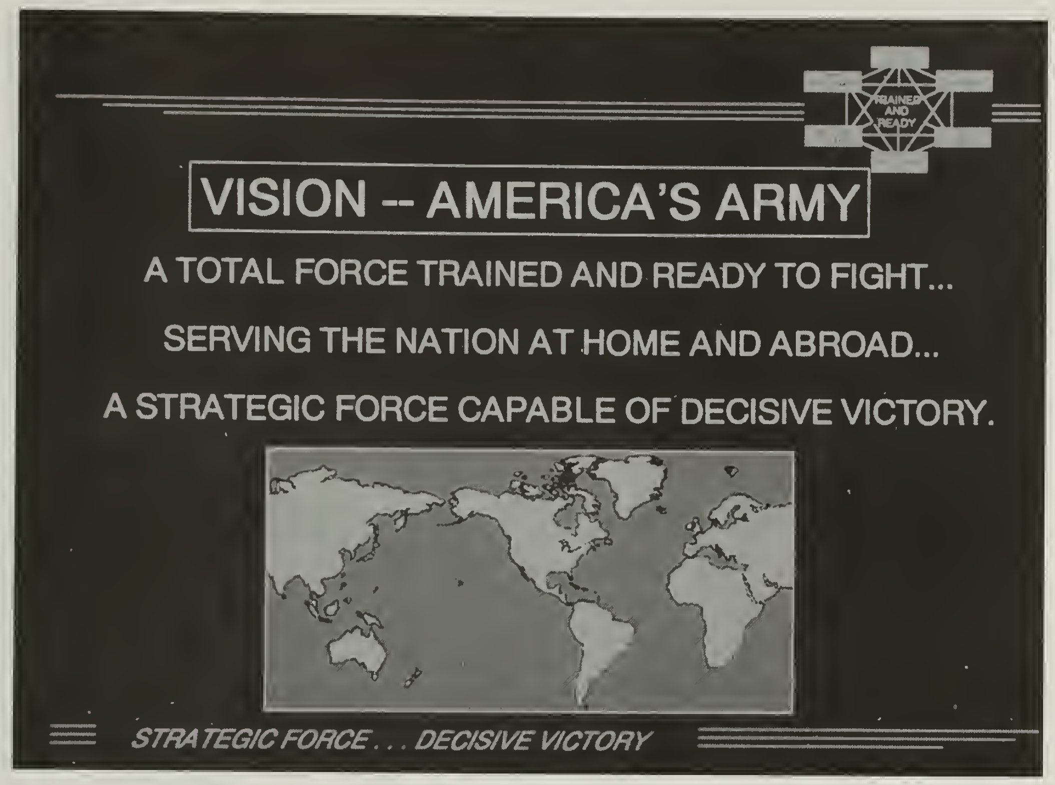
It is a distinct pleasure to be here at Fort Leonard Wood today—the home of the United States Corps of Engineers—and to address your annual conference. I'm especially impressed by the title of your conference. It shows me that you have internalized the fact that training is what binds this Total Army together. And training—focusing on being trained and ready—is what will see us through the challenging times ahead. Your agenda clearly reflects the fact that you are focusing on training and warfighting. This is precisely the right target.

Yours is the fourth in a series of branch conferences that I have addressed over the past month or so. In each case, I have laid out some challenges to the leaders of the branch. Today, I'll be talking to you about moving forward to meet the demands of the future. And how we will work together to achieve the vision and deliver decisive victory when we are called by the American people.

I will start by telling you a little about the challenges I face as chief of staff. These challenges focus on ensuring the Army as a whole can deliver decisive victory into the 21st century. Then I have some points for you as combined arms leaders and those of you in the district engineer community. We will shift focus, but the theme is the same—decisive victory. I will wrap up by looking at what I call the essence of the Army.

My Challenges As CSA

I am sure it is clear to everyone here that the



VISION -- AMERICA'S ARMY

A TOTAL FORCE TRAINED AND READY TO FIGHT...

SERVING THE NATION AT HOME AND ABROAD...

A STRATEGIC FORCE CAPABLE OF DECISIVE VICTORY.

STRATEGIC FORCE . . . DECISIVE VICTORY

world in which we live has changed, and is continuing to change dramatically. In the next decade, we can expect that the strategic environment will be dynamic, uncertain and unstable.

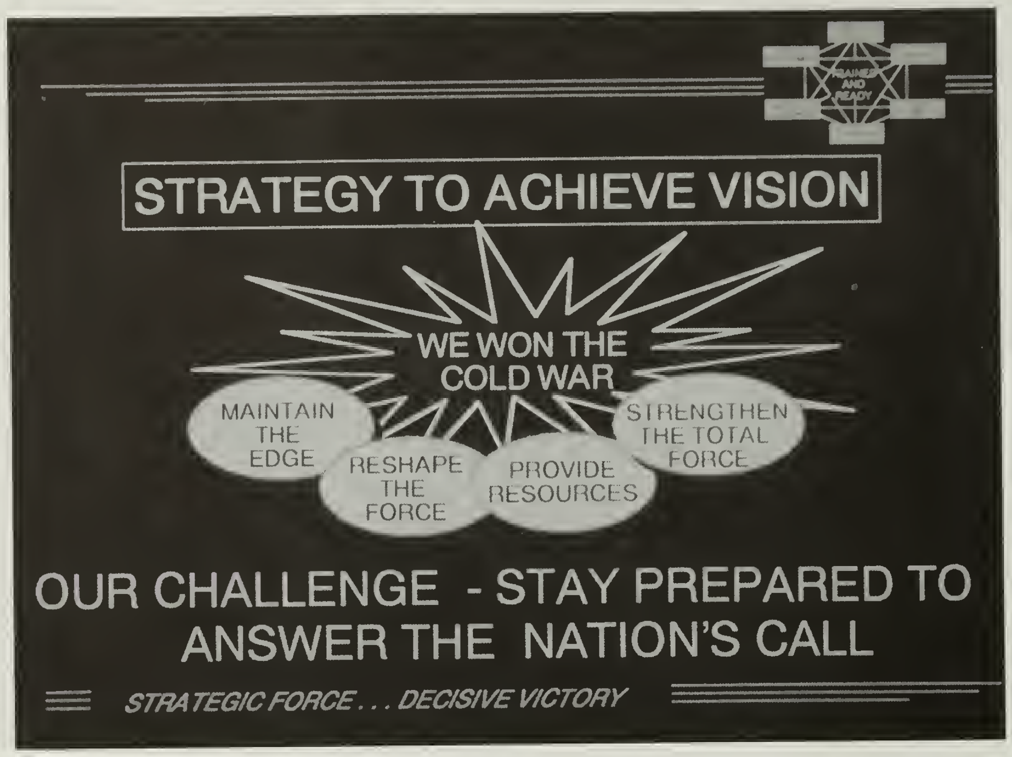
No one here could have predicted the events of the past several years: the fall of the Berlin Wall, Operations Just Cause and Desert Shield/Desert Storm, the dissolution of the Soviet Union, the withdrawal of all Army tactical nuclear weapons. What's next? I don't know. We can't predict.

This environment causes us to place a premium on balance—the ability to respond to the unexpected, the unpredictable. We want to be positioned like the racquet ball player—in the middle of the court, on the balls of his feet, ready for the next play. We must balance the competing demands for continuity and change. On one hand, we must maintain sufficient continuity to keep the momentum of the great, battle-tested Army we have today. On the other hand is the need to change the Army to fit the new world. As we balance continuity and change, we must remember the first rule of wing walking—never let go with both hands at the same time.

Today, we are building toward a vision of America's future Army. In an unstable world, this vision is our beacon. It is our common expectation of what the Army of the 21st century will be. Our vision is: ***a Total Force, trained and ready to fight; serving America*** at home and abroad, and a ***strategic force capable of decisive victory.*** There is a lot of substance in that vision statement. Listen carefully to these points:

- ***Total Force:*** Balanced blend of Active, Army Reserve, Army National Guard, and civilians—each with unique strengths.
- ***Trained and ready to fight***: Our reason for being. We have the fundamental choice to trade force structure for readiness. What we keep will be trained and ready.
- ***Serving America:*** Defined in many diverse ways over our 217 years; today there are 11,000 soldiers serving America in over 55 countries, not counting forward-deployed forces. Many of those are engineers performing peace-time engagement missions to foster peace. But, in the event that peaceful efforts fail, we ultimately exist to fight and win America's wars.
- ***Strategic:*** Based mainly here in the United States, but deployable worldwide. The Army signifies America's ultimate commitment.
- ***Decisive victory:*** America's Army, as part of the joint team, can accomplish national objectives quickly, with minimum loss of life on [both] sides, and with minimum expenditure of national wealth and resources. This is the new standard. America does not want protracted, attrition warfare. In Just Cause and Desert Storm, we demonstrated that we can fight at a level our opponents can't handle. Everyone in this room has a role to play in ensuring we remain capable of decisive victory. And that includes, incidentally, the district engineer community. Consider the case of the Middle East-Africa Project Office (MEAPO) during Operations Desert Shield and Desert Storm—the first and only people on the ground at the start of the crisis; a massive contracting effort that followed; representing a very important and visible role in contingency operations.

The Army's strategy to achieve our vision has four elements—maintain the edge, reshape the force, provide resources, and strengthen the Total Force. I am sure you are familiar with these. The key to maintaining our warfighting edge is keeping the six



STRATEGY TO ACHIEVE VISION

WE WON THE COLD WAR

MAINTAIN THE EDGE

RESHAPE THE FORCE

PROVIDE RESOURCES

STRENGTHEN THE TOTAL FORCE

OUR CHALLENGE - STAY PREPARED TO ANSWER THE NATION'S CALL

STRATEGIC FORCE . . . DECISIVE VICTORY

imperatives in balance. This is where you warfighters come in. I'll talk more about this in a minute.

These are some of the means that will allow us to direct and control change as we reshape the Army. Training is the most important piece of the equation. We must continue to stay on the playing field, balancing our resources to ensure that our soldiers are prepared to fight and win. As General Franks (TRADOC commander) will mention to you tomorrow, we are rapidly moving forward on updating our doctrine in FM 100-5 to reflect the entire range of effort—from mobilization, to deployment, to fighting and winning in joint and combined warfare.

Louisiana Maneuvers is an umbrella concept for a series of netted simulations that will move us into the 21st century as a power projection Army. You are all familiar with the Total Army Quality concept. Part of our efforts to remain a high-performing organization relates to our efforts to improve and streamline our operations. The Corps of Engineers has been a leader in employing many of the principles embodied in this concept.

In the future, our Active and Reserve Components will be working together even more closely. We have learned a great deal over the past year and a half about how we can strengthen the Total Force. FORSCOM's Bold Shift initiatives, which General Burba (FORSCOM commander) will outline to you this afternoon, will help to enhance the integration and readiness of RC units. The first operational readiness exercises (OREs) have been conducted. This summer annual training is restructured to focus on small unit training. The Army of the future requires one tightly knit Total Army team, and I am 100 percent committed to making that happen.

One of the most critical issues we face is controlling the pace of change as we restructure. As we draw down, we must be ready to fight at any time along the way. This means we must reshape deliberately in order to maintain balance. One aspect of maintaining balance is decreasing RC in concert with the AC.

This gives you some facts and figures about the scale of the changes we are making. My message during the recent Congressional hearings was that we must maintain the steady pace of the restructuring.

This is how I view the Army. Again, balance is the key. You here at the Engineer School and those of you in engineer districts are in the institution pillar. Those of you from units are in the center. Our soldiers—how they are developed and the values they share—comprise the third pillar of our Army. I have discussed the challenges we face at the Department of the Army level. I want to shift focus now to your challenges as America's combat leaders. There are a number of similarities between your battlefields and mine. Both are complex, dynamic and unpredictable. Both require a clear vision. Both demand that we focus on a few key tasks

Your Challenge As Combined Arms Leaders

I believe this is the challenge you face—whether you are working here in the school, in an engineer district, or are out in a unit. You must contribute to decisive victory by improving the integration of combined arms on the modern battlefield. We can't maintain the edge and deliver decisive victory by resting on our laurels. We must improve. Our soldiers and our nation expect us to remain the best. This challenge is your link to the Army's vision statement. As engineers, you deliver decisive victory on the battlefield as one of the basic elements of the warfighting team.

What's the problem? Several factors diminish our ability to synchronize combined arms. The complexity of the battlefield has increased, while the commander's tools to command and control that battlefield have not improved proportionately. Also, we Americans tend to be process-oriented, not objective-oriented. We often get hung up on how to do something, rather than where we are headed.

In the wake of our successes in Panama and the desert, some might ask: why change anything? Don't fix something that is not broken. My answer is that we must improve in part because of our great successes. Potential adversaries around the world watched and learned from our victories of the past several years. Our warfighting edge is only relative to a specific enemy at a specific time. Each situation is unique. It would be foolhardy to extrapolate from our past successes to future conflicts. We must improve because others are improving.

Furthermore, the dynamic world situation ensures that for America's Army, the battlefield factors of METT-T are less predictable today than at any time over the past 40 years. For America's Army, there are no longer established GDP plans. This uncertain world requires increased flexibility on the battlefield.

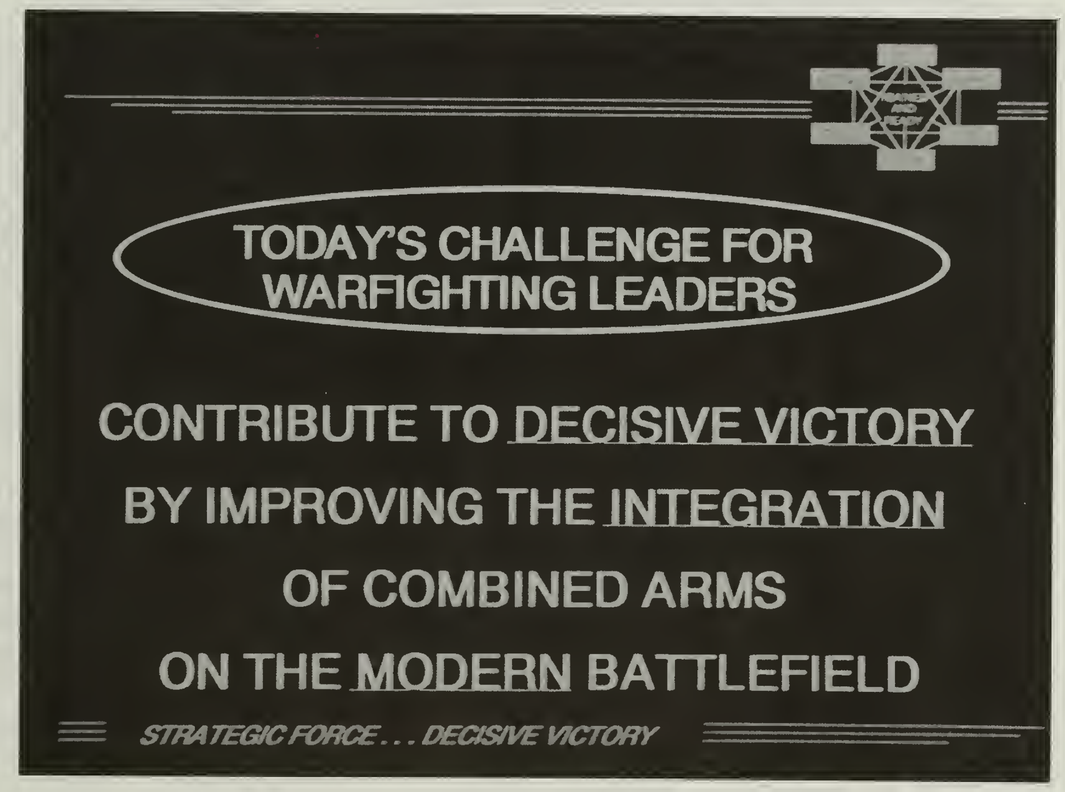
Finally, we must continue to look critically at our abilities and aim to improve. I believe that one of the single most important innovations of the past 20 years—and one of the keys to our edge today—is the after-action review. The AAR provides us an honest appraisal of our performance and directs our efforts to correct shortcomings. In a very broad sense, what I am doing here today is holding an AAR on our ability to integrate combined arms. There is room for improvement.

Part of the problem with integrating combined arms is that the modern battlefield is changing. We can conceptualize the battlefield as a cube with three dimensions—space, speed and time. Today, the cube is expanding rapidly. Thanks to advanced technology, combat operations today take place in larger areas (greater width, depth and altitude), more rapidly and more continuously than ever before in the history of warfare. The commander must control his sector of zone in all three of these dimensions. Enemy and friendly actions (both maneuver and fires) take place on the ground and in the air, and across the electro-magnetic spectrum at an astonishing rate. The overall effect of this expanding battlefield is greatly increased complexity for the commander.

The commander has command and control tools that are designed to help him cope with this complex battlefield. The purpose of these tools is to assist the commander in focusing combined arms combat power at the decisive place and time—while both the place and time are constantly changing. This is a tall order to fill.

General Hal Moore—when commanding lst Squadron, 7th Cavalry at Ia Drang in 1965—summarized the commander's task in the form of three questions: What is happening? What is not happening? How can I influence the action? This is never easy—given the friction and fog of war—but today it is even more difficult.

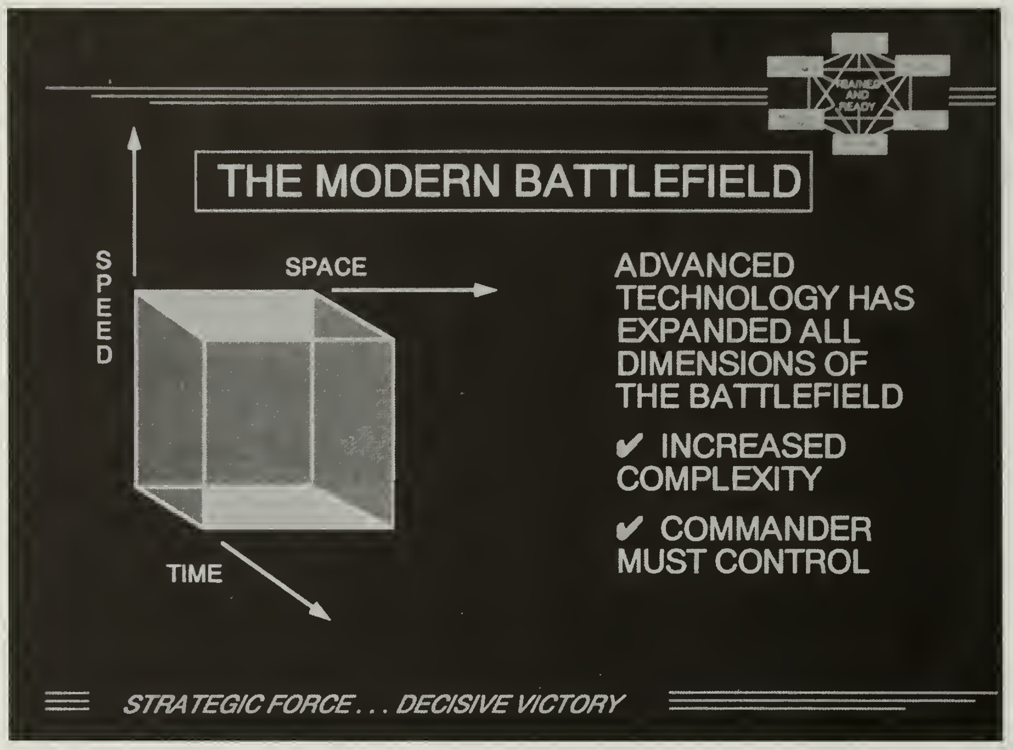
The problem we face today is that our command and control tools have not kept up with the increasing complexity of the battlefield. When I visited General Franks in the Gulf, he showed me the Blackhawk he used as a mobile command post during the war. What I saw inside was not unlike command posts I have seen since entering the Army 30 years ago—a map mounted on plywood and covered with plexiglass; acetate overlays attached with green tape; grease pencils in a can; a bottle of alcohol and a rag; a clipboard; a styrofoam cup with cold coffee. The only items that were new were the kevlar helmets and the commercial bottled water.



TODAY'S CHALLENGE FOR WARFIGHTING LEADERS

CONTRIBUTE TO DECISIVE VICTORY BY IMPROVING THE INTEGRATION OF COMBINED ARMS ON THE MODERN BATTLEFIELD

STRATEGIC FORCE . . . DECISIVE VICTORY



THE MODERN BATTLEFIELD

ADVANCED TECHNOLOGY HAS EXPANDED ALL DIMENSIONS OF THE BATTLEFIELD

✔ INCREASED COMPLEXITY

✔ COMMANDER MUST CONTROL

STRATEGIC FORCE . . . DECISIVE VICTORY

Our command and control tools are lagging behind the expansion of the battlefield.

The evidence for this observation comes from our combat training centers (CTCs). Here are several trends:

- Plans tend to be overly complex.
- The intelligence preparation of the battlefield (IPB) is done well initially, but then lags behind as events unfold—and becomes increasingly irrelevant.
- Combat assets often are not synchronized for overwhelming effect. This applies across different types of forces (armored, light, special operations) within the same command, as well as across all the battlefield operating systems (BOS). Of particular concern, we must continue to completely integrate the engineer into the planning process, and on the ground where the breaches are conducted and the obstacles emplaced.
- Our ability to maintain the momentum we require—***mobility***—is a product of engineer effort at the breach and along the MSRs. Our ability to prevent the enemy from integrating his combat power—***countermobility***—comes from the integration of maneuver, fires, and obstacles to support the commander's scheme of maneuver. Even the most elegant obstacle plans fail to achieve their objective when they are not firmly integrated into the maneuver commander's mindset.
- Finally, our ability to protect our combat assets—***survivability***—depends on your ability to control and prioritize limited assets to protect those systems and control nodes most vital to the fight. When engineer effort isn't synchronized, it represents piecemeal commitment of combat power—that is, violation of the principle of mass. This is evident at all levels above platoon—where every leader is a combined arms integrator.
- The CTCs report that we are becoming predictable in our concepts of operations and schemes of maneuver and fires. The indirect approach that robs the enemy of the initiative is not frequently seen.
- Engineers are central to solving some of these problems. You are the key to ensuring that combat power is applied at the right place and the right time. But we have to be faster and much more agile. We have to synchronize to overwhelm the enemy.

It is important to put these comments in perspective. We are the best army on the face of this planet. No one can touch us today. Our edge is decisive. When the National Training Center opened years ago, units trained there at the high school level of training. Today we are in graduate school at the CTCs. But remember: our challenge is to maintain that edge. And that means improving. That is the challenge I give you today.

How can we improve? I have organized my thoughts around three themes: expectations, priorities, and mental agility. I will spend a few minutes on each.

My first point is that we must develop shared expectations within units. This is important both in our combat plans and in execution. It takes time to build shared expectations. Therefore, much of what I offer here is work for home station. When plans and actions within the unit are readily understood and even anticipated, the result will be increased ability to deal with the unexpected on the battlefield. Operations within the unit must become second nature so that we can focus more on the variables over which we have little control (the weather, the terrain, the enemy).

The first key to common expectations in plans and orders is a clear, concise commander's intent. This is the vision of what the end state of the operation is to be, and why the operation is being conducted. The sooner this intent is known by all, the sooner the unit begins to move toward a common goal.

The commander's intent must be based on a common understanding of the enemy. This is not only the business of the S-2. The commander must visualize what the enemy can do before he can visualize how to defeat him.

A clear commander's intent empowers subordinates to take independent actions toward the unit's objective. This is especially important when, in the course of the battle, fleeting opportunities occur that can be seized with decisive effect if subordinates demonstrate appropriate initiative. Our subordinates are capable of such action if they understand what is appropriate. The commander's intent tells them.

The intent also serves to focus all the elements of the unit on the same end. All elements are synchronized to contribute to the unit's objective. There is a unity of effort.

The second way to build shared expectations in plans and orders is to keep them simple. We can defeat ourselves before the battle even begins if our plans are complex, requiring multiple intricate steps and flawless timing. Simple plans are relatively easy to communicate and more readily understood when received.

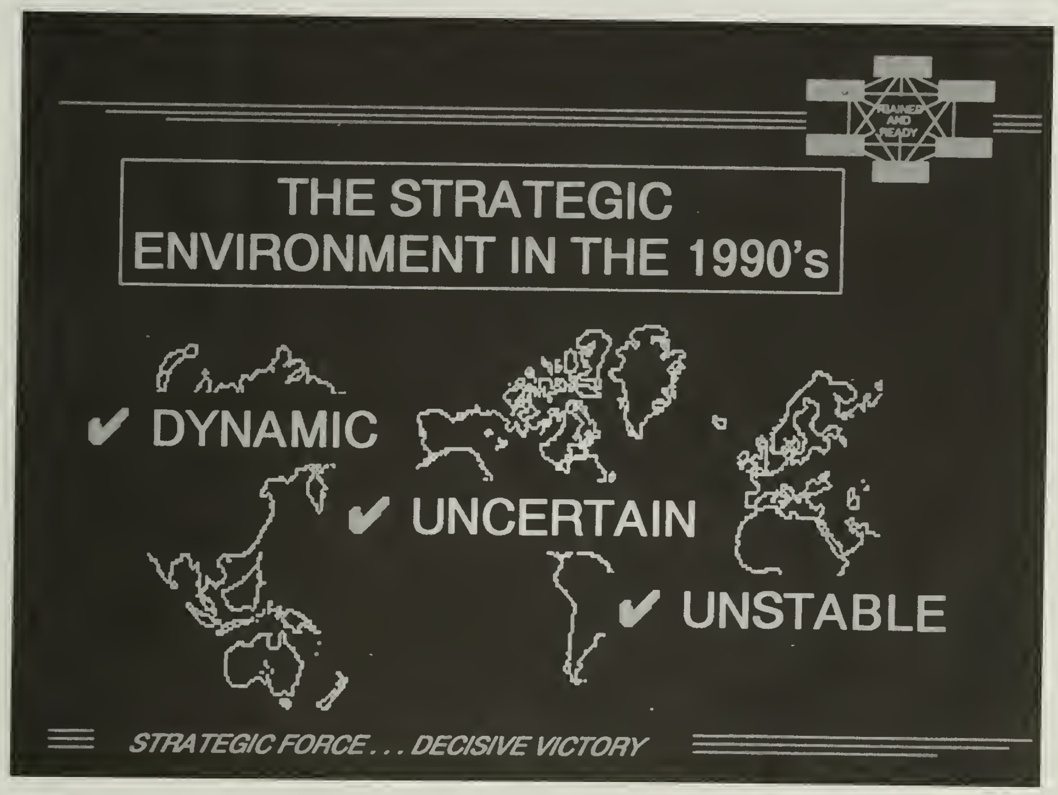
Third, we can promote shared expectations within units by using our approved common language—our doctrine. Types of missions (screen, guard, cover, penetration, envelopment), tactical terms (attached, OPCON, defeat, destroy) and graphics (boundaries, restricted fire lines, obstacles, FASCAM, battle positions) all have standard meanings that minimize confusion if used appropriately. Precision of language contributes to clarity of orders and common understanding. Our school system does a good job of institutionalizing our doctrine. Now we must use it in the field.

Common expectations during execution build upon effective plans and orders. Beyond that, the key to execution is to master the basics. The building blocks for battlefield success are effective small units—crews, squads, platoons. Drills, playbooks, and SOPs are developed and honed to a razor's edge at home station using the crawl-walk-run methodology. Basic skills such as boresighting, constructing fighting positions, and target acquisition must be mastered before battles can be won. This focus on small unit basics is the science of warfighting.

A second requirement for more effective battlefield execution is to have cohesive teams among small units and staffs. Such teams know each other so well, that when the unexpected occurs, their response is clearly understood—and nearly automatic. Cohesive teams also provide the internal support built on trust and confidence that see small units through the toughest battlefield challenges.

To take this logic one step further, a unit is essentially a team made up of smaller teams—a "team of teams." By this I mean that we are first grouped by basic function (tankers, engineers, medics), then put together in multi-functional units (company teams, task forces, brigades) of increasing size. The unit commander's job is to get all these teams working together in harmony. He must know whose team he is on—and who is on his team. He can't build an effective unit if he doesn't know.

Engineers are on the maneuver commander's team throughout an operation. If engineer planning is too important to be left to engineers, then it is equally true that maneuver cannot be left solely to


TRAINED AND READY

THE STRATEGIC ENVIRONMENT IN THE 1990's

✔ DYNAMIC

✔ UNCERTAIN

✔ UNSTABLE

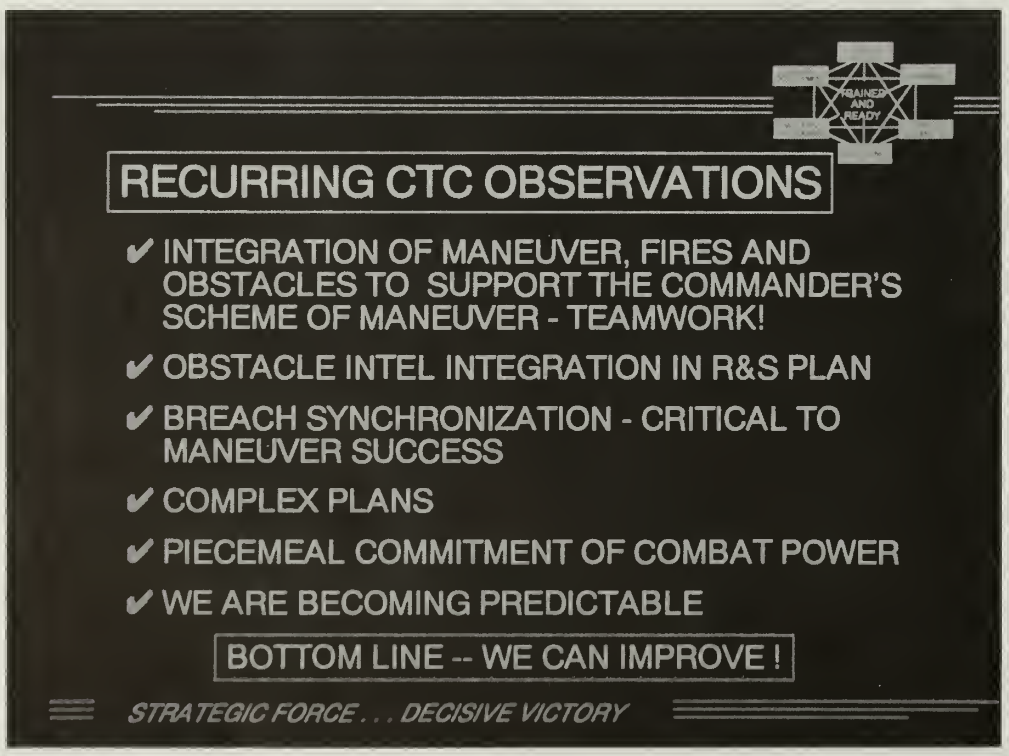
STRATEGIC FORCE . . . DECISIVE VICTORY

infantrymen and tankers. Engineer planning and operations and maneuver must fit together hand-in-glove. This is the responsibility of commanders and staffs, and even the schools. And engineers must remain flexible—despite the Engineer Restructure Initiative and the habitual associations it fosters, the fact is that engineers will always be used to weight the effort where they are needed, and they must be able to work with teams that are not fixed.

The same is true of the district engineer, who is a member of many teams—the Corps of Engineers, the communities and geographical areas they serve, and possibly the CINC's team if they have presence in an overseas area of concern during response to a crisis. There are new dimensions of responsibility for those of you in districts that were not effectively tapped prior to Desert Storm, but will be in the future.

The second point I want to make about improving battlefield integration is that we must do a better job of setting priorities. If any single lesson comes through over and over again from the CTCs, it is that units that fail to focus their resources—fail. We must learn that perfect is the enemy of good. This applies especially during the planning phase when long orders with a dozen annexes and too-long rehearsals eat up preparation time of subordinates and ensure that critical tasks are not accomplished.

Priorities are also key to execution. We often fail to follow up on priority intelligence requirements (PIRs), or fail to integrate engineer intelligence into the R&S plan. Sometimes we disperse our fires rather than mass. Too often we fail to hit the enemy with the majority of our power at the critical point.



RECURRING CTC OBSERVATIONS

- ✔ INTEGRATION OF MANEUVER, FIRES AND OBSTACLES TO SUPPORT THE COMMANDER'S SCHEME OF MANEUVER - TEAMWORK!
- ✔ OBSTACLE INTEL INTEGRATION IN R&S PLAN
- ✔ BREACH SYNCHRONIZATION - CRITICAL TO MANEUVER SUCCESS
- ✔ COMPLEX PLANS
- ✔ PIECEMEAL COMMITMENT OF COMBAT POWER
- ✔ WE ARE BECOMING PREDICTABLE

BOTTOM LINE -- WE CAN IMPROVE !

STRATEGIC FORCE . . . DECISIVE VICTORY

Commanders get paid to determine the critical tasks, then ensure these are accomplished. What *must* be done well? It might be the wargaming process of the estimates process. It might be the recon and rehearsal of a particularly key element of the plan, perhaps the commitment of the reserve. It might be the firing of a FASCAM target group on a high-speed avenue of approach. It might be the completion and overwatch of the key obstacle. Whatever the critical tasks, the commander energizes his unit by identifying them, focusing on them, and then positioning himself when he can influence the action.

My last point on how to improve combined arms integration is that we must develop mental agility. Since the physical tools of command and control have now developed as fast as the battlefield has expanded, we must compensate by being better capable of dealing with the unexpected. Our best tool for doing this is the commander himself. Not some high performance machine.

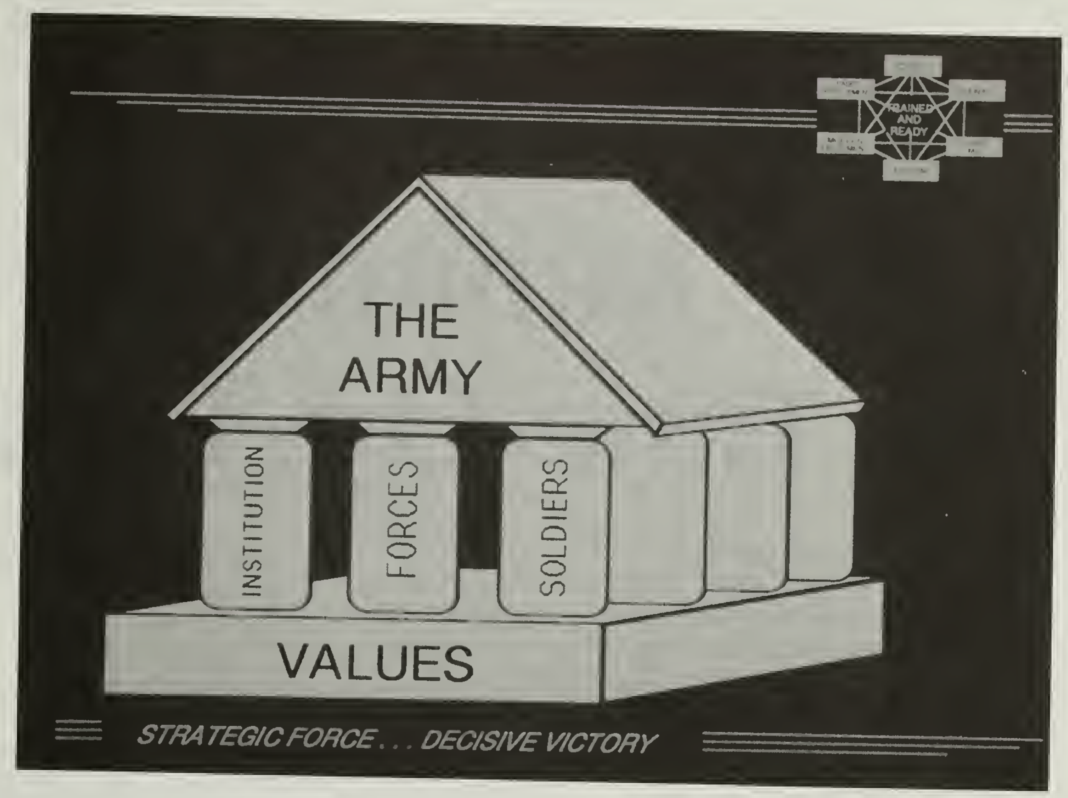
I believe it is part of the American character to look for the technological answer to complex problems. This approach leads us to focusing on the process rather than the objective. We tend to become more concerned with how the task is accomplished, rather than how the task contributes to the overall objective. We have all fallen victim to the 100-slide quarterly training brief and the 2-hour rock drill.

Procedures have a place, but the down side is that they tend to become dogmatic and out-of-date. Procedures are generic and do not account for the specifics of a particular situation. It is all too easy to fall into the trap of believing that the mission will be accomplished if only we can issue the most detailed order, conduct the most complete rehearsal, and complete properly the decision support template (DST). Orders, rehearsals, and DSTs are only tools—they are necessary but not sufficient to win. We must stay focused on the objective. If we get hung up on the process, we will often miss the imaginative approach that can prove decisive.

Developing mental agility can be trained.

We should practice the unexpected in training exercises. Leaders should be confronted with unanticipated turns of events—both positive and negative—that cause them to react.

An aspect of mental agility is recognizing when a plan has outlived its utility and requires major modification. This usually occurs not long after contact is made with the enemy. Commanders must beware of being so fixated on their plan—sometimes because of pride of authorship—that they fail to recognize when it is time to change. Here, the executive officer (serving as second-in-command) and subordinate commanders can play an important role in giving the commander feedback.



Let me give you an example of what I mean. Several months ago, the 101st Airborne conducted an air assault exercise. Apaches were first on the objective and recognized that enemy locations differed from the intelligence template. They relayed this real time intelligence to the task force commander who was already enroute with the assault ships. He adjusted his assault plan and issued new orders. The assault was precise and effective. That is mental agility.

Another case in point is Patton's ability to counterattack against the Bulge in 1944. He was agile enough to turn the Third Army 90 degrees and hit the German advance in the flank.

This is really art, not science. Building such instincts takes years of preparation and practice. The key is that we develop in ourselves and our subordinates the ability to recognize acceptable risks and take them. We can do this by rewarding innovation in our schools, in garrison, and in the field. The time to start is now.

As you progress through your conference, I ask you to think about many of the themes I have mentioned this morning, and some of the issues that will be important to the Corps of Engineers in the coming years. Ask yourself how you can best integrate your essential capabilities into the fight, to include the capabilities of your combat, topographic, and heavy units—as well as your district offices and project offices. Discuss the modernization efforts, roles and missions that support our overall vision for the Army.

Ask yourself how you can better assist in our efforts to integrate the RC and to train them to the readiness level required in the next war. Ask yourself how you can improve your methods of training to make them more realistic—and more economical. Demo effects simulators are an excellent example of that concept, and the potential is there for more such ideas. As engineers, you are an important part of the combined arms team—in peace and in war—and a key element of the formula to achieve decisive victory.

Those are my points on improving the integration of combined arms. I hope I have given you some food for thought.

Summary

These are challenging times for all of us. Just as the international environment is changing fast, so too is the modern battlefield changing. When challenges arise, soldiers look to their leaders. This is a time for leadership.

When we opened the NTC a decade ago, we didn't know where it would lead us. Today, we are a much better Army, but there is still room for improvement.

We must remain fixed on one standard—protect and defend the Constitution and the Republic. Provide decisive victory when the nation calls.

Minimizing Time-On-Target

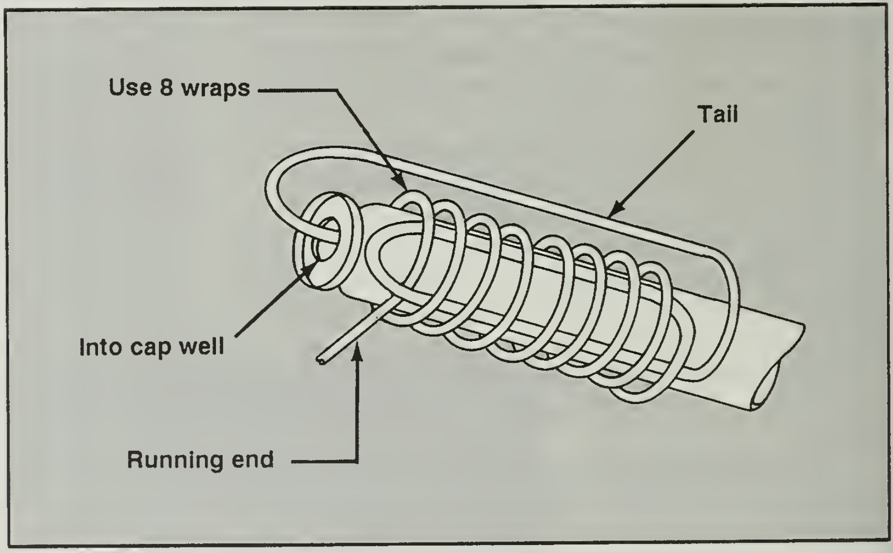
By Captain James Dawkins

When attacking maneuver forces are waiting for supporting engineers to clear obstacles, "time on target" becomes critical. The less time you spend preparing demolition charges on the target site, the less your soldiers are exposed to enemy fire, and the faster the attacking force can move through the breach.

Priming charges in a rear safe area is one way to reduce time on the target site. This is especially true if the breach is to be conducted under chemical attack conditions. Since charges should not be transported with caps in them, detonating cord can be used instead. FM 5-25, *Explosives and Demolitions*, pages 2-23 and 2-24, and its replacement, FM 5-250, pages 2-13 and 2-14, outline the use of detonating cord with both C-4 and TNT. A bangalore torpedo may also be primed with det cord.

The inset shows the proper use of detonating cord in priming a bangalore torpedo. The following cautions should be noted:

- Use eight wraps only - more wraps may cut the bangalore without detonating it; fewer wraps may pinch the bangalore tube without detonating it.



Det cord priming of bangalore

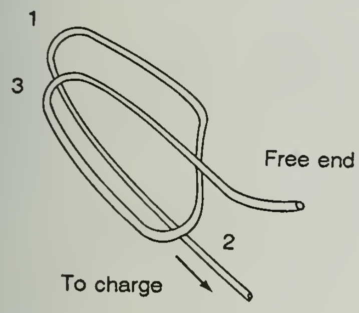
- Det cord wrap should start at the edge of the bevel, working toward the center of the tube. This ensures that the booster is covered by the cord.

- When counting wraps of det cord on the bangalore, count on the side opposite the knot.

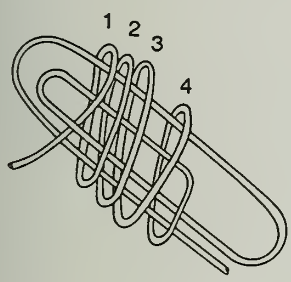
Save time by connecting the primed charges to the line main or ring main. Det cord clips work well in normal conditions, provided you have them. However, trying to clip in while wearing a chemical mask and gloves is difficult at best. Additionally, the traditional girth hitch with an extra turn is difficult and time consuming—even without chemical gear.

Several knots have been developed to connect branch lines to the line main or ring main. These knots are easily attached—even in full chemical gear. The first of these is the cherry knot:

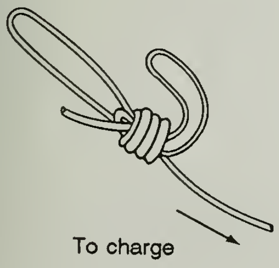
(1) Make three bights in a piece of det cord. There should be approximately 36-48 inches of det cord for this knot.



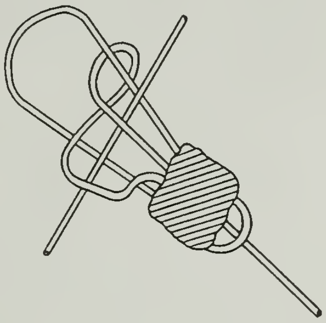
(2) Tightly wrap the free end of the det cord four times around all three bights. Pull the third bight down tightly on the free end of the last wrap. Ensure the standing end adjusts the outer bight.



(3) Fold the lower bight forward over the wraps and tape it in place. Adjust bights before taping.

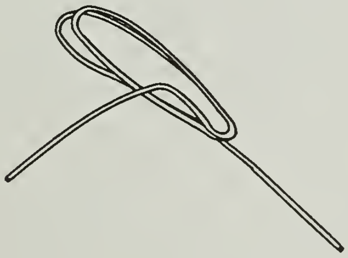


(4) Place the line main between the two bights of the cherry knot. Insert the lower bight into the upper bight, capturing the line main. Close the cherry knot by pulling down on the standing end, while holding onto the lower bight.

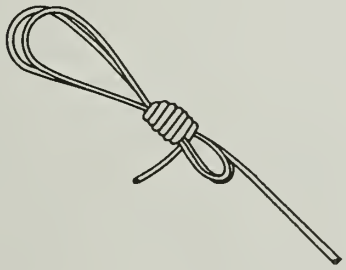


The next technique is the Gregory knot. It's similar to the cherry knot, but requires no tape:

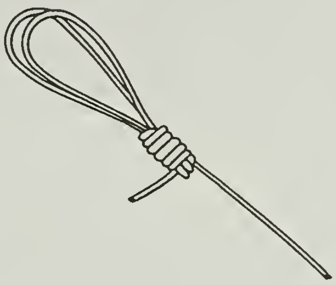
(1) Make four bights in a piece of det cord. Loops formed by the bights should be 4 to 6 inches in diameter. Squeeze the two bottom loops to form tight bights.



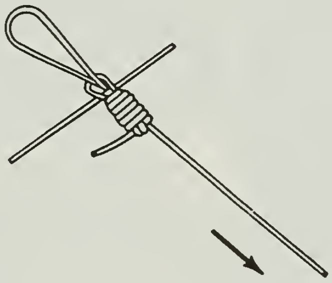
(2) Make four to six wraps with the running end toward the bottom. Feed the running end through both of the bottom loops.



(3) Hold the wraps and pull each of the top loops to secure the knot.

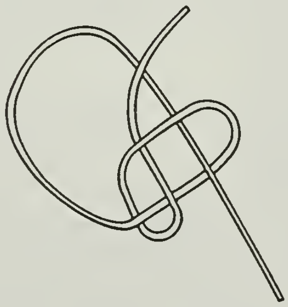


(4) Place det cord between both loops, place the moving loop over the stationary loop. Grasp the stationary loop or wraps and pull the standing end to complete the connection.

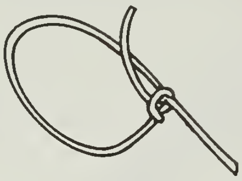


The last technique for connecting branch lines to line mains or ring mains is the Scanman knot. This knot is effective and requires less det cord than either the cherry or Gregory knots:

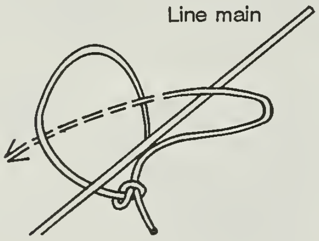
(1) Tie knot as shown.



(2) Tighten the knot but not the loop.



(3) Thread the running end over the det cord and through the loop. Pull the standing end and tighten the loop. The free end should cross the det cord, which is held securely by the loop. The knot should have a minimum 6-inch tail after being secured.



- Connections should be at 90-degree angles to prevent an angle cutoff failure.

Take care when using det cord in arctic conditions. At low temperatures, the det cord's covering becomes stiff and may crack when bent.

Time will always be critical for engineers supporting maneuver forces. However, safety should not be sacrificed for speed.

The techniques outlined in this article will decrease the time required to set up and tie in charges. The key is for units to train hard to ensure successful, safe missions.

Captain Dawkins is a demolitions instructor for the Engineer School. He previously served as commander of Headquarters Company, JTF-Bravo, Honduras. He is a graduate of the Engineer Officer Advanced Course and Combined Arms and Services Staff School. A graduate of Wichita State University, he is also a certified blaster in Missouri.

(Personal Viewpoint continued)

automatic weapons. But they lacked confidence in such infantry skills as fire and support, and keeping track of cleared areas and friendly units, problems often associated with urban terrain. Although the mission was successful, the NCOs knew they were lucky that the enemy had offered little resistance.

Mission 3 - Security to Command Post. Our last infantry mission came when the 24th Infantry Division began to destroy Iraqi forces along Highway 8. We had just finished marking the route to Highway 8 when the intelligence net reported that an Iraqi Republican Guards force was careening headlong toward our brigade. I put the company into a security laager on the road and began coordinating a follow-on mission with the S-3.

Dawn broke to the deafening roar of Multiple Launch Rocket System rockets streaking overhead toward columns of moving Iraqi infantry. When the brigade commander, Colonel John LeMoyne, drove past, he paused and in his own words, was "thrilled to discover an engineer company available to me." Colonel LeMoyne ordered us to move in immediately behind the TAC. We were to provide mounted and dismounted security to the TAC and to destroy all tanks, APCs, and artillery on the highway that "he didn't get first."

Our 14 lumbering dump trucks, dragging bolster trailers loaded with thousands of pounds of explosives, fell into Colonel LeMoyne's fiery caravan. At halts we dismounted and patrolled the area to flush Iraqi soldiers from bunkers and culverts. On the move we blew up the few pieces of Iraqi equipment not destroyed by the colonel. Although we executed our incoming artillery battle drill, the potent trailers escaped any direct hits, and the Iraqi infantry had little stomach left for fighting.

Lessons Learned. After the cease fire, I reflected on how fortunate we had been. Fortunate that the Iraqis we met generally put up little resistance. Fortunate that we had a foundation of infantry skills to draw upon to accomplish our missions. For example, precommissioning and basic officer training adequately prepared platoon leaders for simple infantry missions, such as the perimeter defense. The NCO schools had taught my sergeants the fundamentals of squad fire and maneuver. But neither leaders nor soldiers were prepared for a complicated task such as clearing a bunker complex at night. Although successful, I believe we were inadequately prepared to participate in close combat in the middle of the combined arms fight. For example, had the enemy fought more aggressively, I would have had poor communication with armor and infantry units on my flank, and virtually no ability to call for artillery fire. And I will bet that our infantry skills are typical of most engineer companies in today's Army.

My maneuver commanders did not hesitate to use engineers in an infantry role. They assessed our firepower and engineer mission, and decided we could best influence the battle as infantry. They expected us to have the infantry skills required to exploit the capabilities of our firepower. I contend that our engineer doctrine should reflect those expectations.

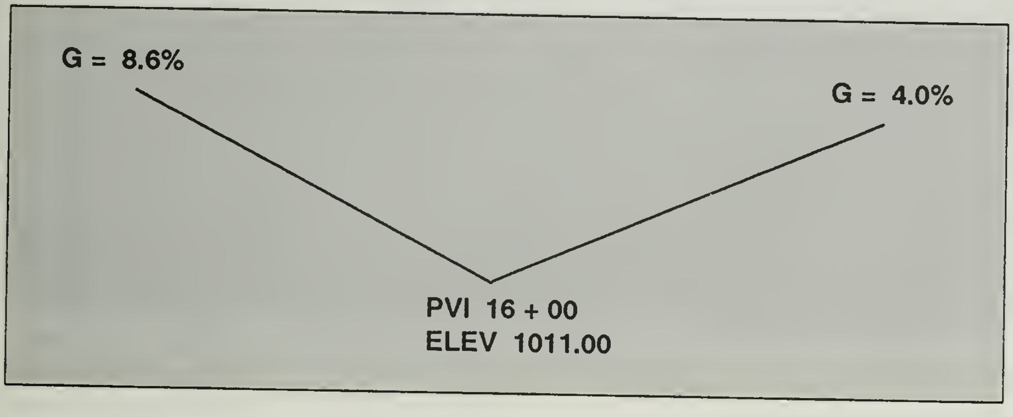
To "fight as infantry" is not an unlikely mission for future engineers. Thus, the combat training centers should re-evaluate the combat engineers' role as infantry before we learn hard lessons in a conflict against a more tenacious foe, in more restricted terrain, than we faced in the Gulf.

Captain Laky is pursuing a masters degree in nuclear engineering at the University of Missouri-Rolla. He commanded Delta Company, 5th Engineer Battalion, during the Gulf War.

Engineer Problem

You have been tasked to re-grade an existing road section to protect a pipeline and provide drainage.

The new grades form a new point of vertical intersection (PVI) at station 16 + 00, with an elevation of 1011.00 feet. The new centerline passes over a 6-inch, high pressure, natural gas line at station 15 + 20. The top of the pipeline is at elevation 1017.00.



You are to determine:

1. The length of the vertical curve required to clear the pipeline, with 4 feet of minimum cover at the road centerline.
2. The low point on the curve, where a culvert may be located.
3. The centerline grades for surveyors to use for staking purposes.

Hints for success:

- Draw a sketch of the vertical curve.
- Locate the position of the pipeline in relation to the grade line.

References:

TM 5-330 and various civilian surveying or route location publications.

Note: FM 5-430, scheduled for publication in the 2nd quarter of FY 1993, will replace TM 5-330 and include additional design information.

ENGINEER Solution on page 51.

Maintaining Mobility With A Treadway Road

By Major Thomas J. Kelly

Putting a bridge across a river is no guarantee that supported forces will be able to continue a successful offense. The 44th Engineer Combat Battalion (Corps) confronted just such a situation in Korea during Team Spirit 91. Two brigades of armor and mechanized infantry of the 2nd Infantry Division had just crossed a river, and had the opposing forces on the run.

But division units were getting short on food, fuel, and "bullets." The 2nd Engineer Battalion had built a ribbon bridge across the river, and the division's supply trains began moving toward the crossing site. The first HEMMT (heavy-expanded mobility tactical truck), loaded with badly needed supplies for the brigades, rolled onto the farmer's field that separated the MSR (main supply route) from the crossing site.

Less than halfway across, the truck became hopelessly mired in mud over its axles. It was obvious that nothing with wheels could get to the bridge site. An approach road was needed—and fast—or opposing forces would regroup and "destroy" the division's two brigades on the other side of the river.

The Korean terrain poses special challenges for crossing operations. The countryside is extremely mountainous with highly compartmentalized mobility corridors. Many rivers and streams restrict or impede movement, and most suitable crossing sites have poor access and egress routes. Farmland covers most useable rural terrain. And since rice is the primary crop, most of the farming areas have been designed to trap and hold water. This makes movement for wheeled vehicles difficult or impossible.

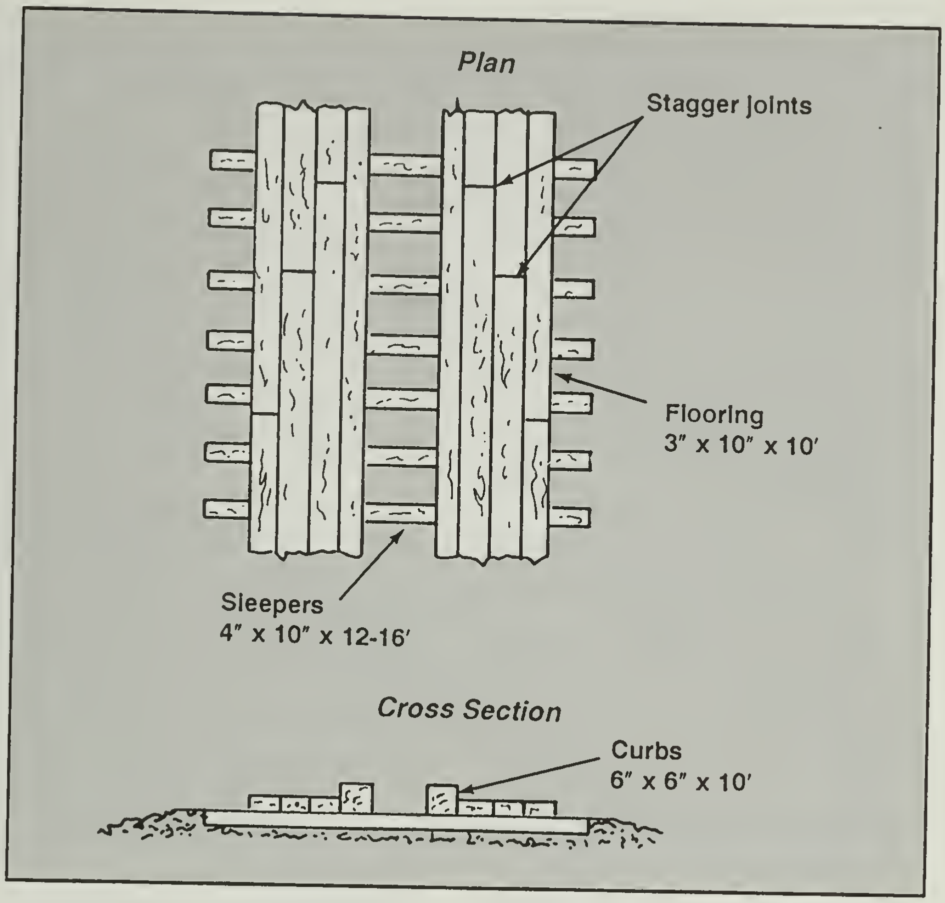
The crossing site was separated from the MSR by about 300 meters of farm field. To reach the site, the 2nd Engineer Battalion had driven their ribbon bridge trucks along a tractor path. This was done with great difficulty, and the trucks heavily rutted the path across the field. This, combined with a steady rain, made the field impassable to further wheeled traffic.

The 44th's major challenge was to quickly upgrade the access road across the field, and the battalion started bringing in fill material from the river banks. The material found in most Korean riverbeds makes excellent road base material. However, the haul capabilities of the unit's 5-ton dump trucks were limited, and scoop loaders and dump trucks were needed elsewhere in the division area. The S-3 estimated it would take a week to upgrade the road, but the tactical situation allowed only three days to get the job done.

The battalion commander learned of a large quantity of lumber in the division support area, and directed the battalion staff to develop a plan for a corduroy road. The battalion S-4 immediately inventoried the available lumber, and the staff assembled to determine a suitable road design.

Based on the materials and time available, we immediately recognized that the treadway road design on page 2-20 of FM 5-34 was an ideal solution. The treadway road required much less material and work effort than a corduroy road. And since most of the lumber sizes required were available in the division's lumber storage yard, only minor modifications would have to be made to the FM 5-34 design. Additionally, almost no extra lumber would have to be cut. The staff recommended the treadway solution to the battalion commander, and he told the unit to go with it.

The S-4 took charge of moving materials to the crossing site, which was located about three hours from the division storage area. Working through the night, he coordinated movement of the battalion's cargo HEMMTs and forklifts to the division lumber storage yard. The cargo HEMMTs were well suited for delivering the materials. They could be easily loaded by forklift with palletized lumber, and had their own cranes for off-loading. This proved to be invaluable at the crossing site because of the limited maneuvering space and lack of other material-handling equipment.



FM 5-34 plan for "plank tread road." The 44th modified these specifications for their own mission.

The S-4 configured each HEMMT load so that it carried all required materials for 25 meters of treadway road. This enabled our one on-site company to begin building complete sections of road as soon as the first truck reached the site. It also speeded up construction, since loaded trucks could be driven out to the end of already completed treadway road, and unloaded for further construction.

Charlie Company, the on-site unit, had only one line platoon and support platoon available. Because a treadway road is a labor-intensive project, more men were required. An additional 30 Korean laborers from the 30th Korean Service Corps (KSC) augmented the company. This host nation support proved critical to the successful and timely completion of the road. The 30th KSC has been OPCON to the 44th since shortly after the end of the Korean War, so it was easy to integrate them into the construction project.

To start the road, Charlie Company cut a shallow slot in the ground to form the road base. About 130 meters of gravel roadway was laid down at the end of the treadway road closest to the MSR. Throughout the operation, the 44th continued to improve this section of the road. At the crossing site, a dozer was put to work building about 20 meters of graveled road from the river to the treadway road.

The plans in FM 5-34 were invaluable for rapidly and concisely communicating the road design to the officers and NCOs in the construction unit. In its operations order, the battalion specified the section of FM 5-34 where the design was located, a list of modifications, and a list of materials being delivered to the site. Charlie Company then had the option of further modifying the design as necessary, and the S-4 sought out the additional materials.

The unit used the same sleeper materials specified in FM 5-34. However, 3-inch by 12-inch lumber was used for the flooring instead of 3-inch by 10-inch because large quantities of that size were available in the division storage yard. We also did not use curbs.

We found that the modified design enabled the road to carry all of the division's wheeled traffic. This included fully loaded ribbon bridge trucks, fuel tankers, and cargo HEMMTs.

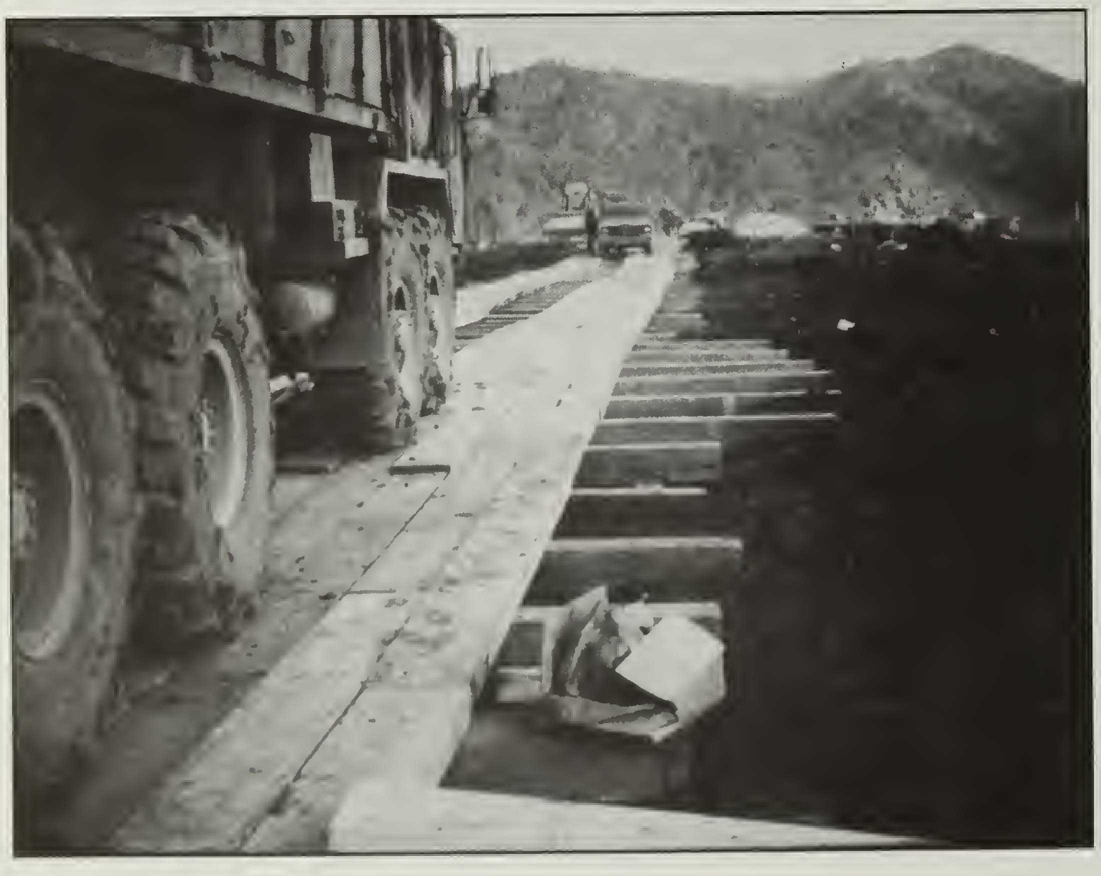
The platoon leaders and NCOs of Charlie Company developed several changes to the original design. The FM 5-34 design does not specify nail size, but the company found that at least 60d nails were needed. Smaller nails did not adequately fasten the treadways to the sleepers. As vehicles went over the road, the flooring popped off the sleepers.

The company also kept the gap between the treadways to 3 feet or less, enabling CUCVs and HMMVs to easily traverse the road. They also increased the treadway width to 48 inches. This allowed all of the wide vehicles to easily negotiate the road. As a result of these last two changes, all vehicles were able to travel the road—even at night—without inadvertently dropping off the edge.

The battalion experienced very limited maintenance problems with the road. We established a stockpile of spare lumber and nails to repair broken treadway boards. However, no boards broke or failed due to wear. Several factors contributed to this.

First, only wheeled traffic was allowed on the road. A separate shallow slot had been cut parallel to the treadway road, allowing tracked vehicles to drive to the bridge. MPs at each end of the road enforced this division of traffic. Secondly, the unit required a ground-guide for each vehicle. This requirement ensured that vehicle speed was regulated to minimize vehicle impact loads.

However, had the road been in service for a longer period of time, repair of broken or damaged boards would have been a significant maintenance requirement. The only real maintenance requirement resulted from nails that worked loose along the treadway. A team of Charlie Company soldiers had to regularly walk the length of the road and hammer in loose nails.



Supply vehicles move over a completed section of the treadway road. While the road was under construction, each HEMMT traveling to the end of the road was configured with all the materials required to build 25 meters of treadway.

A Charlie Company soldier nails a 3-inch by 12-inch flooring plank. To make it easier for vehicles to travel the road, each treadway was widened to 48 inches—a modification to plans found in FM 5-34.

The road turned out to be a ready-made obstacle during the retrograde—an added bonus for the 44th's efforts. After the last division forces had re-crossed the river, the battalion pulled up about three-quarters of the road. The muddy gap that remained was impassable to the opposing force's wheeled vehicles, so the crossing site they "captured" was useless as a supply route.

Picking up the road, however, was a real logistics effort for us. The crossing site was congested and we had great difficulty in getting enough men and trucks to pick up and haul the lumber away.

The project was completed in 36 hours with more than 150 meters of treadway road and about 150 meters of graveled road constructed. The officers and NCOs of the battalion gained valuable experience in innovative engineering.

The construction of the graveled portion of the road was a major training opportunity for Charlie Company. The dump truck drivers were all new 12B combat engineers. They learned how to rig and then use their dump trucks to spread fill material—something they had never done before.

The company had also been augmented with a dozer from the 2nd Engineer Battalion and a 621B scraper from the 82nd Engineer Company (CSE). The 12B NCOs learned how to use that equipment and supervise an earthmoving operation.

Another major benefit of the operation was exercising battalion staff planning procedures. The backward planning process was used to synchronize the planning, logistics, and construction of the road with the requirements of the maneuver commander. Additionally, the staff wargamed the whole operation, enabling us to anticipate problems and keep the battalion responsive to the needs of the on-site company.

The maneuver commanders also benefited from the experience. They were surprised and impressed by the resourcefulness and skills of their supporting engineers. They suffered no loss of mobility during the offensive, and the unexpected benefit of turning the road into a retrograde obstacle proved a significant tactical benefit to the division. Overall, the treadway road project helped reinforce the importance and value of engineers as vital members of the combined arms team.

Major Kelly is a principal investigator of construction robotics applications for the Army at the Construction Engineering Research Laboratory in Champaign, Illinois. He previously served as executive officer for the 44th Engineer Combat Battalion (Corps). Other assignments include battalion S-3, engineer group S-2, group and battalion assistant S-3, battalion S-4, company commander, company executive officer, and platoon leader. He is a graduate of West Point, and holds a master's degree in robotics from Carnegie Mellon University. He is a graduate of Command and General Staff College, and is a registered professional engineer in Virginia.

BUILDING AN UNBEATABLE DEFENSE

By Second Lieutenant Steven McGugan

During a company rotation to the Joint Readiness Training Center (JRTC) at Fort Chaffee, Arkansas, my platoon was charged with building defensive positions for the opposing forces (OPFOR).

It was a valuable experience. In particular, learning how to fully integrate obstacles and maintain close coordination with the supported infantry commander were highlights of the assignment.

This article is intended to share some of those experiences with other engineer platoon members.

> "...how to fully integrate obstacles and maintain close coordination with the supported infantry commander..."

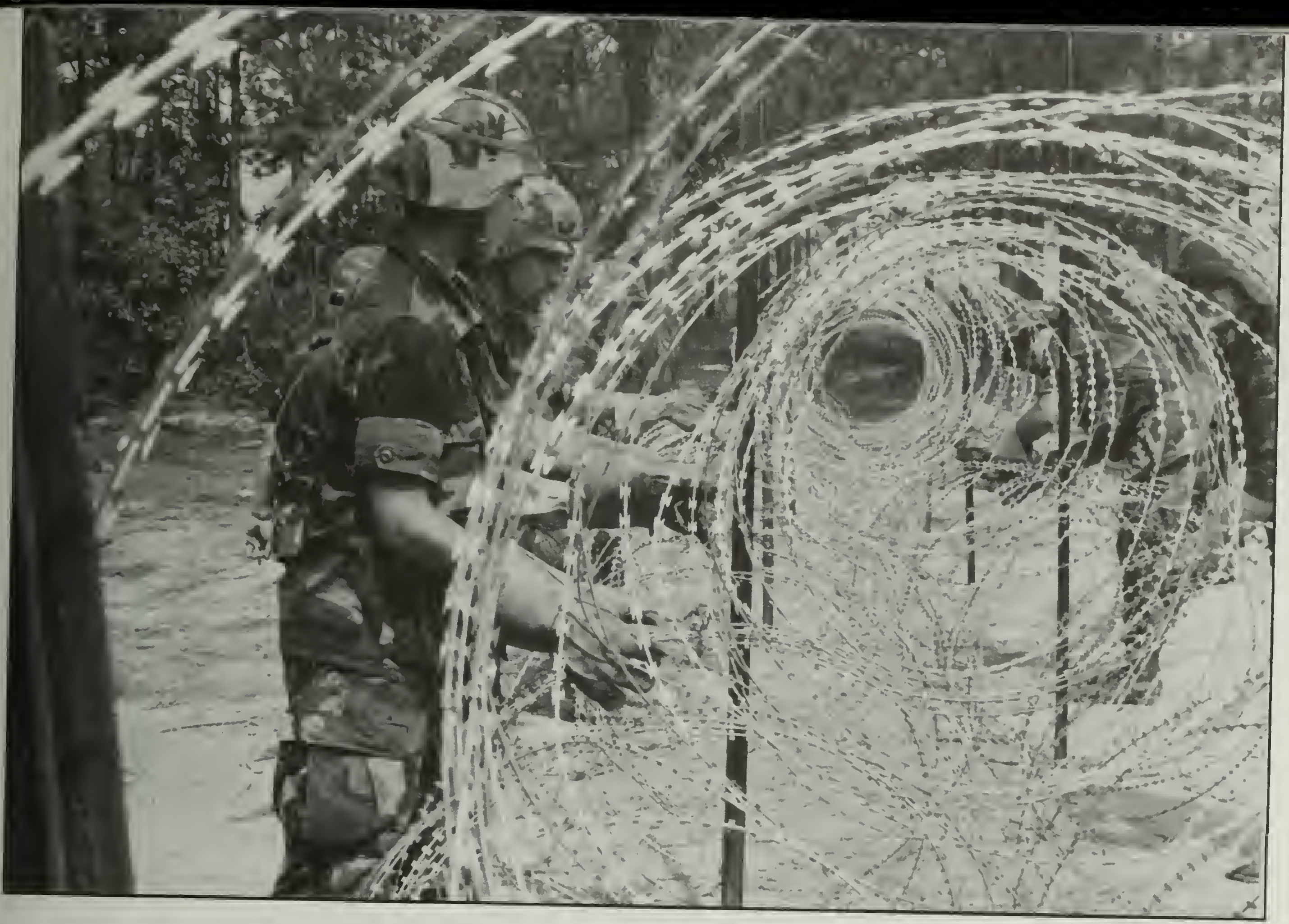
Coordination

In order to make each defensive position as successful as possible, the engineer platoon leader must fully understand all of the maneuver commander's operational concepts and intentions. Well before each defensive operation at the JRTC, the infantry commander and the platoon leader would get together and go over the plan. This was necessary because the engineers normally moved onto the defense site one or two days prior to the infantry unit. The platoon leader and the commander then jointly developed the defensive plan using maps, sketches and even aerial photographs. Several aspects of the defense had to be covered:

Type of Defense. Knowing the type of defense to be fought ensures that the engineer leader's use of the terrain meets the infantry commander's needs. For example, if a full, 360-degree perimeter cannot be established, the engineer wants to know where the infantry commander is willing to accept increased risk.

Sub-Unit Locations. Friendly infantry movements around the defensive site must be known to the engineers. This is critical to maintaining security and ensuring that counter-reconnaissance conducted by the engineers is effective.

Crew-Served Weapons. Finally, the platoon leader must be clear on where the infantry commander wants his



crew-served weapons. Both leaders want to ensure that the weapons cover main routes or key pieces of terrain. Since the objectives at JRTC were normally defended by 30 to 40 men, and the attackers often struck with a battalion-sized force, this was a critical factor in the defense's survival.

Once the engineer and infantry leaders are on the same sheet of music in these three areas, the engineer needs to turn his attention to counter-reconnaissance and deception. These actions do not have to occur in a particular order, but do have to be conducted concurrently with site preparation.

Counter-Reconnaissance

We found that the better the counter-reconnaissance, the greater the chances of surviving an attack. Successful counter-reconnaissance ensured that attacking forces were denied positive identification of concentrated defenses.

The engineers accomplished this by using combat patrols of three to five men. The size of the patrol is important. During the initial building phase, the highest threat the engineer leader faces is observation by long range surveillance detachments (LRSD). These units normally move in small teams and do not want to make contact. If the engineer leader puts out patrols that are smaller than three men, chances are good that the LRSD can take them out and continue their surveillance mission. A three- to five-man patrol would usually make the LRSD back off. Counter-reconnaissance patrols larger than five men limit the manpower needed to build defenses and provide local security.

After the platoon leader decides on the size of his patrols, he must determine when and where they should move. The best time to send them out is after stand-to in the morning and just before stand-to at night. This clears the area and keeps the attackers unsure about activities at the defensive site.

These patrols should move in a fan method that covers 360 degrees of the perimeter, and should be conducted at a range of no more than 1 to 2 kilometers. At JRTC, we found this method to be the best means of countering attacking unit reconnaissance.

A critical follow-up to the patrols was the establishment of listening post/observation posts (LP/OPs). The number and location of these depended on the terrain, but as long as they could report to the platoon leader and they could see and/or hear enemy activity, they proved successful. In fact, the patrols and LPs/OPs were so successful that the LRSD commander, at the conclusion of the exercise, stated that his scouts were never able to observe construction of our defenses.

Deception

Running effective deception activities proved just as

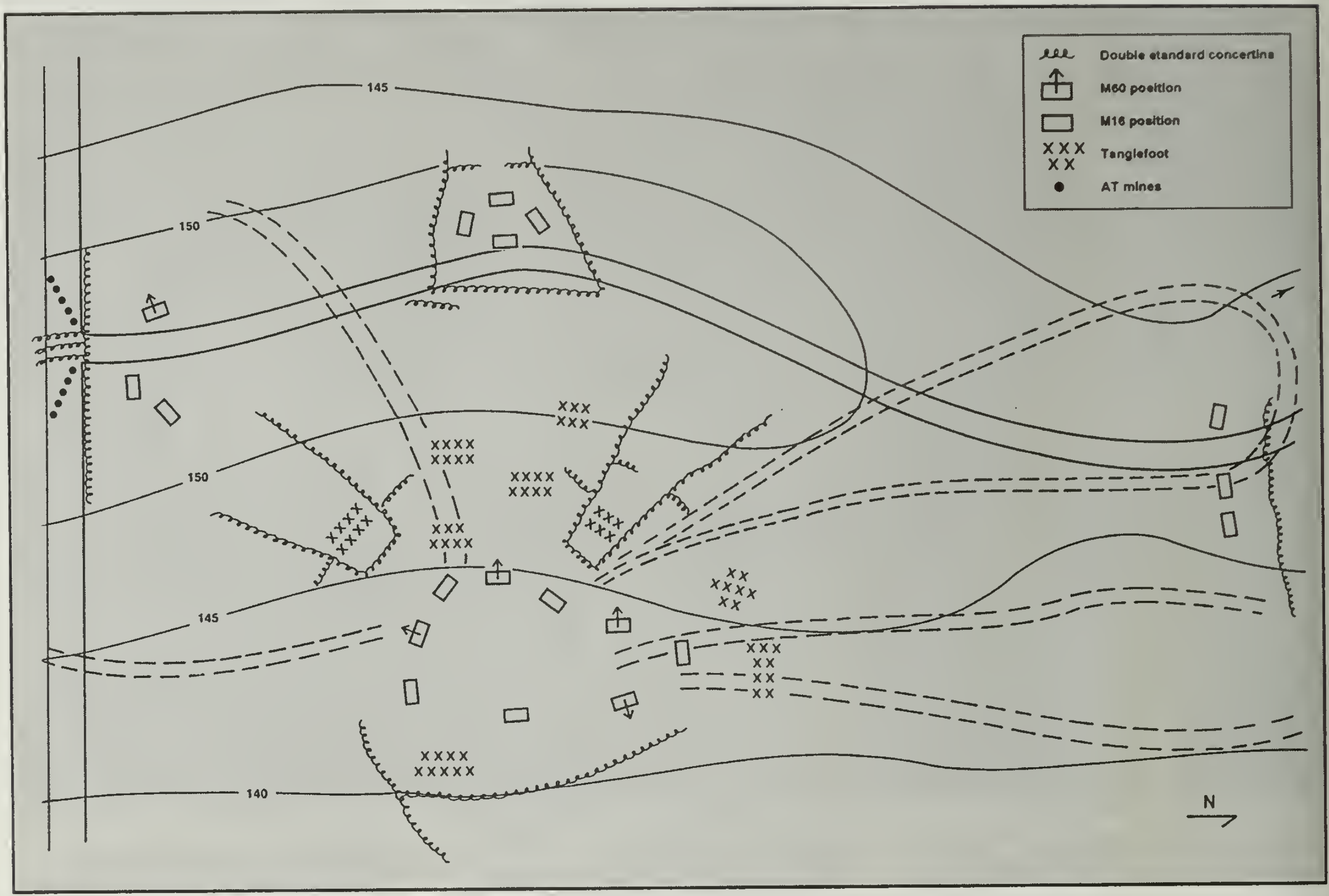


Figure 1

important as counter-reconnaissance. The deception plan called for showing movement in a location that was easily observed by the attacking forces. While the enemy concentrated effort and firepower on a false position, the real location of the platoon's defensive construction remained hidden.

Our deception called for moving unneeded supplies to the "target" area. Boxes, miscellaneous equipment, and some soldier activity created the illusion that the OPFOR was establishing a position there. This compelled the attacking forces to dedicate valuable resources to neutralizing the site.

Deception does not have to be visual. Noises that mimic position construction will also draw the attention of attacking forces. At the very least, attackers will dedicate men and time to investigating the source of the noise.

Smart Basics

Another point driven home at the JRTC was that the smart implementation of basic fundamentals goes a long way toward building a successful defense. First, a lot of time went into walking the terrain, "sighting in" fighting positions, and gauging fields of fire. After fighting positions are finalized in accordance with the infantry commander's wishes, the engineer platoon leader ensures that they provide the soldiers maximum coverage from indirect fire. He also makes sure that this overhead cover does not limit the soldiers' ability to provide fire support to all four sides of the perimeter.

Finally, smart construction allows the defender to minimize time spent on camouflage, and devote more time to the obstacle plan. For example, make overhead cover 18 inches high and, when possible, try to lower the plywood base below ground level so that it covers the silhouette.

Wire

Tactical and protective wire was critical to the success of the JRTC defensive positions. First, always place protective wire so that it prevents the enemy from throwing grenades into the defense. The platoon leader should then use tactical wire to create turning and channeling obstacles.

Wire is high on an infantry soldiers "hate" list. At JRTC, it

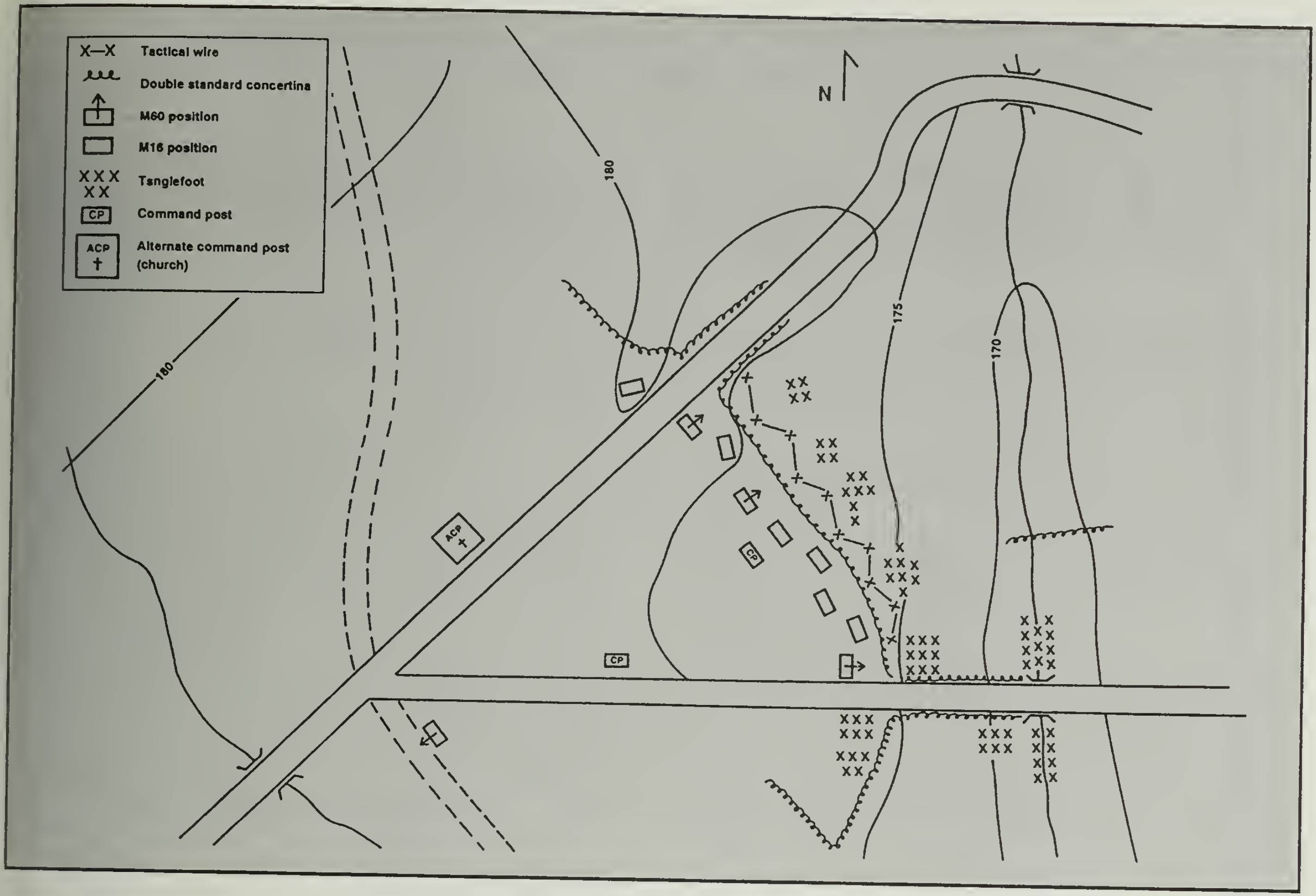


Figure 2

did not take large amounts of it to slow or even stop them. We also found that triple standard concertina (TSC) could be modified to a double row design. Although this design doesn't appear in current field manuals, we found it to be an adequate obstacle. Construction is basically the same as for TSC, but with the two rows of concertina stacked on top of each other. While perhaps not the best choice for actual combat, the idea could be useful in situations where there is a shortage of wire and time.

We also learned the value of tactical wire as a channelizing and turning obstacle. The wire was placed at such angles that it turned advancing soldiers into the direct line of fire for crew-served weapons. All "dead" areas were laced with tactical wire, and covered as much as possible by the defensive position's individual weapons. Tanglefoot was also used in these dead areas. Close coordination with the infantry commander on the placement of obstacles and crew-served positions helped to ensure the success of this tactic.

Defensive Positions

To illustrate how some of these lessons were put to use, let's look at the three positions built during our JRTC rotation. For each defensive position, fighting positions were dug the first day on the site. This allowed soldiers time to emplace wire obstacles the following day.

In the first defense (Figure 1), a reverse slope technique was used. The slope of the hill was wired in such a way as to direct the infantry into the fire of M60 machine guns. The use of tanglefoot behind large trees helped to exclude their use as hiding places by the attacking infantry.

The double-dashed lines in the illustration show the approximate routes for counter-reconnaissance. While the routes for this site did not go out that far, the patrols were still successful. Note that the infantry commander accepted some risk on his eastern flank. This risk was discussed with the commander prior to construction of the site.

In the second defense (Figure 2), the engineers were given the eastern flank of a village to defend. The infantry commander deemed this flank the most likely avenue of approach because the creek bed

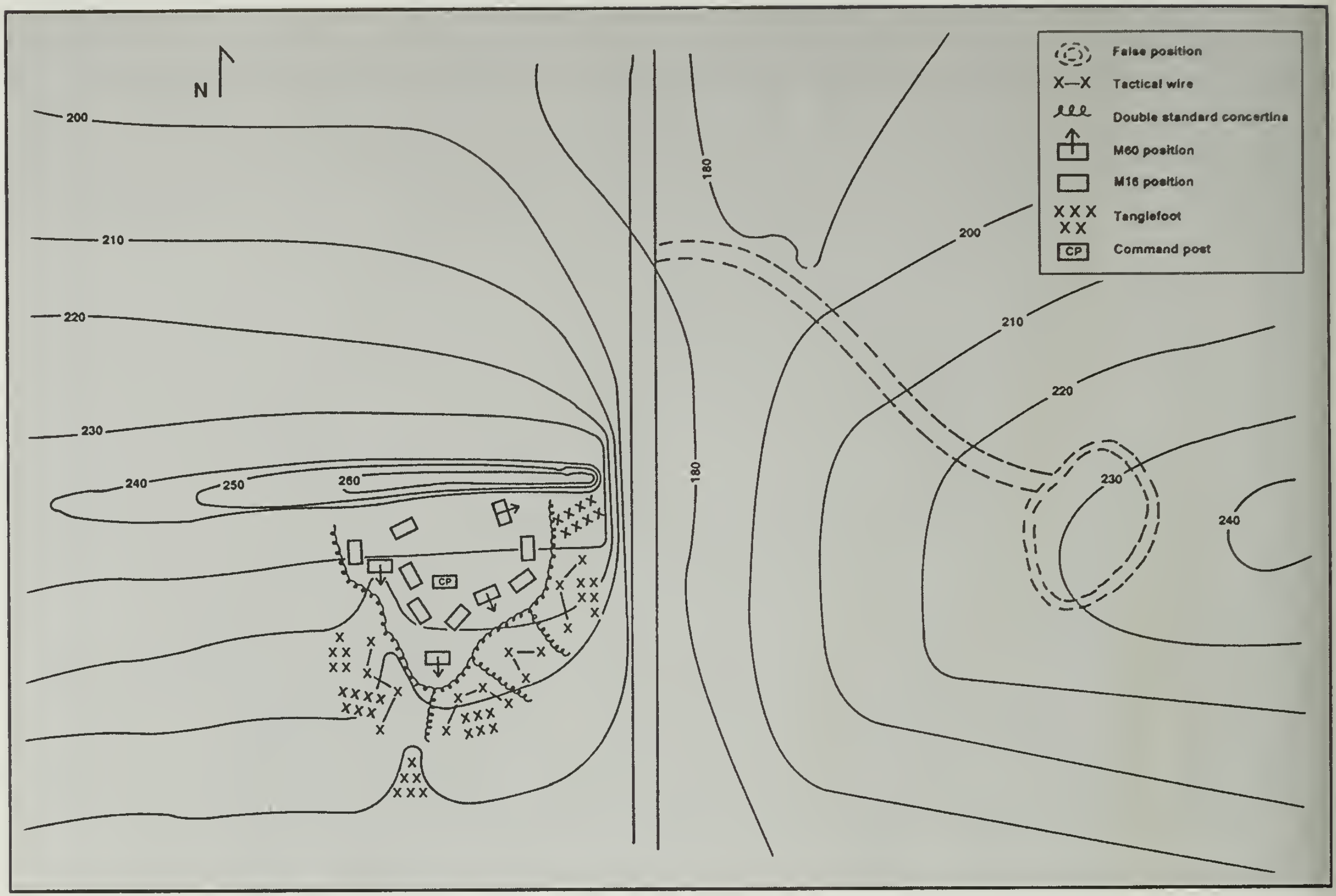


Figure 3

was covered with woods. The engineers' main effort was to this woodline. While the rear of the defensive line seems to be open, the ability of the engineers to turn around in their fighting positions and fire to the rear was deemed sufficient coverage.

Note that the tactical wire is in a "W"-pattern in front of the protective wire. In addition, it was built so that the "V" of the wire pattern was placed in front of the M60 machine guns, or other positions designated to fire at a rapid rate. In the east, the use of tanglefoot across the road prevented a crawling approach by the enemy, and created easier targets for machine gun fire.

In the last defense (Figure 3), the engineers had to defend another reverse slope—but this time a sheer rock cliff was to the north. Notice how counter-reconnaissance was conducted in two directions, in conjunction with the placement of three LP/OPs. This was more than ample to ward off LRSD patrols and allow secure site operations.

The other side of the narrows was also brought into use as part of a deception plan. U-shaped pickets, barbed wire, and concertina wire were carried to this hill. The deception worked so well that the attacking forces devoted a company-sized force to secure it. Wire was used again to deny the enemy the ability to move laterally. The crew-served weapons had excellent fields of fire because of the upward slope the attackers faced.

During the unit's stay at JRTC, each defense benefited from lessons learned from the preceding one. Solid defensive positions depended on:

- Close coordination between the maneuver commander and his supporting engineer leader.
- Smart engineering of each site, making maximum use of time, tactical techniques, and materials.
- Maintaining priorities, with a balance of effort to both security and construction.

Following these basic guidelines will allow engineer leaders to successfully defend against even a vastly larger attacking force.

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LESSONS LEARNED:

Engineer Mobilization, Administrative and Logistics Techniques

The following administrative and logistics lessons apply to Army engineer units mobilizing and deploying for training or combat. Mobilization training and security lessons will appear in a future issue of ENGINEER.

These lessons apply primarily to Army Reserve and National Guard (NG) engineer personnel and units, but they also pertain to Active Army engineer forces. They are based on observations made during Operations Desert Shield and Desert Storm. For more information, write to Commandant, U.S. Army Engineer School, ATSE-ESA, Fort Leonard Wood, MO 65473-6630. Or, call (314) 563-5304, DSN 676-5304.

ISSUE: More than 70 percent of today's Army engineer force is made up of Reserve Component (RC) units and soldiers. It is critical that they can mobilize quickly to go any where, any time in support of Army missions around the world, either for peacetime training or wartime operations.

Most of the Army RC personnel called to active duty for Operations Desert Shield/Storm were proficient in the administrative and logistics tasks needed to get them into the theater of operations. Those that were not, however, were delayed at mobilization stations and bumped out of deployment sequence. Some units were delayed as much as three weeks in deploying out of the country.

DISCUSSION: Mobilization is primarily an administrative and logistics process, with available training time concentrated in common task areas such as weapons firing, NBC proficiency, and physical fitness. FORSCOM Regulation 500-3-3, Volume III, *Reserve Component Unit Commanders Handbook (RCUCH)*, dated 1 March 1991, describes actions that will ensure personal and unit mobilization readiness. Ask yourself two questions: "If I (or my unit) is called to active duty today, could I (or my unit) mobilize, deploy, and be ready to support Army missions worldwide? If not, what am I doing to get ready?"

A total of 39 engineer RC units were mobilized during Operations Desert Shield/Storm. Several hundred engineer individual ready reservists and individual mobilization augmentees also were mobilized to support those operations. The following administrative and logistics requirements were identified as critical in getting units and personnel into the theater.

Administrative Readiness

◆ Review Military Personnel Records Jackets (DA Form 201). Ensure that emergency data (DD Form 93) and insurance selection forms for all personnel reflect the correct marital and beneficiary status. Soldiers who fail to change records after a divorce or remarriage may have future benefits go to ex-spouses or unauthorized family members.

◆ Pre-enroll yourself and your family members in the Department of the Defense Eligibility Enrollment System (DEERS). This system provides access to active duty medical care and other agencies, and enables you and your family members to receive active duty identification cards (DD Form 1173). Family members may be denied active duty medical care when DEERS authorizations are delayed.

◆ Review financial records (DA Form 3716). Ensure that you and your soldiers are enrolled in Sure-Pay (direct deposit, check to bank). If not enrolled, family members may not receive funds because checks will be mailed to soldiers being deployed. Allotment checks may arrive late, causing financial hardships to family members.

◆ Make available, in a safe place, legal records and documents that allow others to execute actions when you and your soldiers are away. These records and documents include wills and testaments; powers of attorney; insurance policies; divorce decrees; custody court orders; birth, wedding, and death certificates; property titles and deeds; and tax information. Actions or benefits to authorized persons may be denied or delayed when soldiers are deployed if no legal documentation is available. For example, a spouse will be unable to transfer an automobile title that is in the soldier's name unless a power of attorney has been identified.

◆ Ensure family care plans (DA Form 5305-R) for single or dual-service parents are clearly articulated, verified, and up-to-date. Soldiers will become non-deployable if providers refuse or fail to follow family care plan agreements.

◆ Ensure medical and dental records for you and everyone in your unit are current and complete. Soldiers must have on-hand, current physical examinations, immunizations, NBC protective mask inserts, and panographic dental x-rays.

- Identify and process for discharge soldiers who lack "over age 40" physical examinations, are continually overweight, fail Army physical fitness tests (APFT), or have physical profiles that prevent deployment. Many units lost key leaders when they became non-deployable due to medical problems that had gone unreported for years.
- Find resources for soldiers to obtain regular dental checkups. Poor dental health, the most frequent medical problem RC soldiers encounter, will result in processing delays and pulled teeth.

◆ Maintain up-to-date mobilization files in accordance with FORSCOM Regulation 500-3-3. Avoid notification problems due to incorrect telephone numbers and addresses by checking alert rosters and strip maps during monthly drills. Ensure that personnel identified for early active duty call-up and advance parties have the expertise needed to expedite the mobilization process. Administrative and supply personnel are key players for early call-up.

◆ Maintain your unit at or above the 100 percent authorized personnel level. Units selected for future activation will have strong recruiting and retention programs. Ensure that your unit manning reports (UMR) reflect the correct military occupational specialty qualification (MOSQ) status of personnel, and that personnel are slotted where they actually work. Use excess personnel to cross-level and replace non-deployable soldiers.

◆ Implement family support programs that create a sense of community for widely dispersed RC engineer families. Units may form rear detachments using non-deployable personnel or personnel from higher headquarters at local armories and reserve centers. Such detachments are a critical link between family members and deployed soldiers. They provide access to mail and telephones, and information on active duty benefits, medical and dental care procedures, and the Red Cross. They may also serve as public media contacts, control rumors, and coordinate farewell and return activities.

◆ Develop a strong employer support program at the unit level, and implement it during all unit training deployments. Such programs help ensure rehiring rights when soldiers return and enhance the morale of soldiers and their families.

◆ Identify and use class A agents and purchasing officers to assist in mobilizing your unit at home station. The local acquisition of needed rations, repair parts, and construction materials by these personnel is very important as units prepare for deployment. In theater, they will perform similar tasks to obtain supplies from host nation sources.

◆ Acquire sufficient automation support, including lap-top computers, facsimile machines, and copiers. This equipment is essential for units to process accurate information on a timely basis, and should be included on unit property authorization documents. Currently, most units have their automation equipment as installation property, which cannot be taken to mobilization stations.

Logistics Readiness

Soldiers. Inspect individual soldiers periodically to ensure that they have adequate quantities of serviceable clothing, including battle dress uniforms (BDU), combat boots with extra laces, underwear, socks, and towels. Some soldiers arrived at mobilization stations with worn out or missing boots and BDUs. Some were unable to obtain replacements until they arrived in theater because their mobilization station had shortages in common clothing sizes.

Maintenance. Establish effective equipment maintenance programs to ensure mobilization readiness:

- Schedule and conduct preventative maintenance checks and services (PMCS) and required services during each drill by unit soldiers, not just by full-time maintenance support personnel. Well maintained tactical and engineer vehicles, trailers, weapons, hand tools, mine detectors, NBC, food service and communications equipment are critical to unit combat readiness. Develop and maintain a sense of equipment "ownership" in your unit.

- Identify Class IX repair parts required for mobilization and deployment and make them readily available to your unit. Some National Guard maintenance units may not release required engineer repair parts purchased with state funds instead of federal funds.
- Take extra prescribed load list (PLL) and authorized stockage list (ASL) repair parts to alleviate shortages in theater. Critical repair parts commonly needed in contingency theaters include heavy equipment cutting edges, and vehicle filters and seals.

Movement. Be flexible in planning unit movements, and prepare to meet many deployment options:

- Plan for military and civilian deployments via road, rail, air, and sea.
- Practice and document equipment loading procedures when preparing for annual training and overseas deployments. Ensure load cards accurately reflect vehicle and container load plans.
- Spread loads among cargo containers rather than loading containers with like or similar items. This will enable your unit to start work quickly in theater even if some cargo containers are late or lost in transit.
- Provide personnel for port and supercargo operations. This will reduce in-transit damage to equipment.
- Load extra blocking, bracing, and tie-down materiel to alleviate follow-on shortages at mobilization stations.
- Update your Computerized Movement Planning and Status System (COMPASS) data bases periodically. These data bases are used to provide automated unit equipment lists to movement planners at mobilization stations and must be accurate.

Supply. Carry manual backup supply accounting systems in your hip pocket. Supply accountability may be hindered because current Active and Reserve Component automated data processing (ADP) hardware and software are incompatible. Inspect mobilization supply areas frequently to ensure that supplies on hand are adequate for an immediate mobilization at all times.

Class I. Contract home station food service operations because unit food service equipment normally will be shipped out.

Class II. Load extra tentage, generators, engineer power tools, chemlights, fluorescent tape, batteries, office supplies, and CTA-50. These items are critical, and extra on-hand supplies will offset shortages in theater.

Class III. Ensure you have enough fuel on hand at all times to get to the mobilization station.

Class IV. Stockpile and ship enough construction materials to support your unit's mission and life support requirements in theater. Fabricate your own picket pounders.

Class V. Standardize your weapons ammunition basic load fill quantities with other, similar engineer units. Locate where your unit will receive its basic load and plan pickup procedures at the mobilization station, the port, and in theater.

Class VI. Load sports and other activity equipment to enhance the morale of personnel. Pack adequate feminine sundry stocks.

Class VII. Ensure major equipment items are on hand and ready for shipment. Be aware that any major equipment shortages you have prior to mobilization probably will remain short throughout the operation, even after cross-leveling.

Class VIII. Load adequate stocks of medical supplies.

Class IX. See Maintenance section.

Facilities. Units without a rear detachment should establish procedures to turn over unit facilities and installation property smoothly, possibly with assistance from higher headquarters.

- Ensure that secure facility communications systems are available during the mobilization process. Facsimile equipment and secure telephones are essential.
- Use protective structures, access control points, and guard details to secure your facilities during mobilization.

CONCLUSIONS: All RC engineer personnel can learn valuable lessons from the recent mobilization and deployment to Operations Desert Shield/Storm. The bottom line is: To be proficient in the mobilization process and to prepare for future contingencies, units must practice, check, and update their mobilization procedures. And, they must integrate these procedures into training whenever possible. By honing your unit's mobilization process, you can prevent many problems from occurring after your unit arrives at a mobilization station and in theater.

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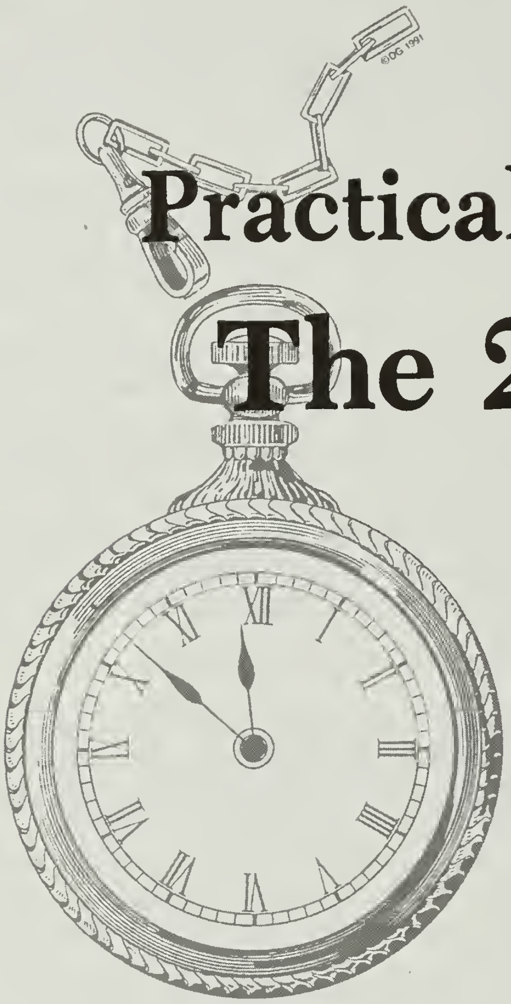
Practical Leadership — The 20/80 Rule



By Colonel Herb Harback

I guess it's bothered me for some time but I never could put my finger on it. I felt it each time I spent too much effort on a particular decision or project, and missed doing something else I wanted to do. I felt it when I had to wait while others added their "finishing touches" to what I considered a completed effort. I felt it when seemingly endless minutes ticked by while my boss "fine tuned" a totally tuned issue. All I could think was "why?"And my inner thoughts were saying "come on, enough already!"

I'm now convinced that one does not have to dot every "i," cross every "t," or proof every word when it comes to daily events. Decisions can be made without Herculean data collection efforts. Decisions can have blemishes. The costs are too high for an absolutely fail-proof, 100 percent on-target, type of decision-making process every time. The "get me ALL the facts before I decide" way of doing business is just not practical leadership.[1]

Focus on Net Gain

Practical leadership requires a decision-making style in which the end result is greater than the effort expended. I call it "20/80 leadership." It simply means that for about 20 percent of your energy and resources, you should expect an 80 percent completion rate. And often that is close enough to get the job done. To get that last 20 percent of accuracy, refinement and perfection—in other words, to get within a zero defect, total confidence level—you would have to commit enormous additional effort and expenditure of resources. The last 20 percent may cost up to four times more effort than did the first 80 percent.

I am totally convinced that the 20/80 rule is a critical part of being a successful leader. As a battalion commander, I would make it a point to seek out the officer or NCO who, at the expense of other pressing missions, would feverishly work on one issue—just to get that action perfect. I would then load that leader up with multiple demands until he finally realized that he had to finish that one action in order to get me off his back on the others. The teaching point was that he could accomplish far more in the same amount of time by making decisions at the 20/80 mark.

What I am saying is that pinpoint accuracy is not a normal decision prerequisite; rather, one strives to get within a standard and then move on.[2] There is abundant truth to the adage that "an 80 percent solution is far better than a 100 percent idea." Sure, if time permits, one goes back and fine tunes—but do not count on it. Do it to standard with 20 percent of your effort the first time around. The object is to get within an acceptable band of excellence,[3] not to get to an absolute certainty mark.

A realistic goal in the corporate world is to be better than the competition. In the military, it is to have the edge over your enemy—to accomplish the mission and then move on. In other words, don't overdo it. If you do, you'll miss other waiting missions. The 20/80 rule tells you how to increase the number of successful decisions within a given amount of time.

Now, 20/80 does not mean accepting a half-right, half-wrong (in other words, half-baked) solution. Rather, it is a mindset of not spending a lifetime on one action at the expense of others. If you do encounter the "must be 100 percent perfect," zero-defect mission, I recommend that you examine it with a critical eye. In most cases, relooking and redefining the issue into more basic terms will get you back within the 20/80 boundaries for a forward moving decision.

Likewise, 20/80 does not mean a lack of attention to detail. It is not a free ticket for sloppiness, shortcuts, or excuses for failure. The concentration of effort within a shorter amount of time should encourage a greater, not lesser, amount of attention to detail.

20/80 should be taken in the spirit of its intent, rather than its exact percentages. That number combination is based on my experiences and observations over the last twenty years. But the numbers are secondary to the goal of obtaining the greatest number of acceptable results within a given time. Could 15/85, 30/70 or 50/50 be more accurate ratios?

Perhaps, but if such a question is an issue, then I would say that the point has been missed. In fact, one could make a case that this question illustrates how quickly we can become bogged down on side issues.

There is a point where you stop, make it happen, and then move on. A point beyond which the price paid in a leader's efforts, time and resources becomes too high. General Edwin H. Burba, Jr., past commander of the 7th Infantry Division (Light), and now commander of Forces Command, is clear in his opinion that a leader should not get so caught up in a decision that he finds himself frozen on that one issue. The leader should gather sufficient assets within his control to accomplish his task and then move on.[4] General Burba is talking the 20/80 rule. Don't seek perfection; rather, put sufficient effort into the mission to get it done and keep the organization moving ahead. The return on additional effort is going to be far more expensive than the potential perfection.

The Economics of It All

The Law Of Diminishing Returns. The corporate world understands incremental value. It is an expectation that the return on an investment will be greater than the costs involved. It is also an idea defined in economics as the "Law of Diminishing Returns."[5] It is the key to understanding practical leadership.

This can be illustrated by using a wet towel as an example. The first wring of the towel easily yields water, the second wring provides less, and so on. With each new try, the energy needed to squeeze the towel increases, while the amount of water quickly lessens. Soon it becomes unprofitable to continue—the cost is greater than the gain. The application of that law in decision making can be seen as you "fine tune" an issue over time. You will spend an inordinate amount of effort for those last drops of perfection.

Time Value. Time is a precious resource which increasingly reveals its value as we use it up.[6] The 20/80 rule recognizes the importance of time as the leader's most critical resource. The more he fine tunes an issue or tries to gather additional information, the more time he consumes. Decision making must take place within the limits of the time available. The more time you use trying to wring out that wet towel, the less time there is for working other missions. Diminishing returns, coupled with the consumption of time, underscore the need for practical leadership in decision making.

Opportunity Costs. A follow-on economic principle which comes to bear in practical leadership is that of "opportunity costs."[7] There is a cost to every decision and that cost is felt in the opportunities you miss because you are focused on something else. It is directly connected to the 20/80 rule. If you do more than is needed, you will exceed the 20 percent effort and begin to experience diminishing returns. You will increase your overall costs because there are more and more opportunities you cannot undertake as long as you are wrapped around the decision-making axle.

As you carefully torque yourself trying to perfect a decision, you consume additional time, money and effort which cannot be recovered. Opportunities to do other things, to make other decisions, to use your resources in other ways, disappear. Time marches on. While you may have made a completely correct decision, you may have lost in the long run because of the inappropriate amount of effort focused on that one action. Economically speaking, the 20/80 rule is the key to practical leadership.

Other costs, too, lurk in the shadows if you insist on "hedging your bet" and holding out for additional information before making a decision. First, you will quickly deplete your resources of time, initiative and momentum. Additionally, you will start to lose your overall focus during your scramble for all possible details on one issue. Because of that, any concurrent actions will come into risk. The probability of making uninformed new decisions will increase. The overriding fear of failure is sometimes shown in these decision-making delays.[8]

When Exception is the Rule

One of the essential things in following through with the 20/80 rule of leadership is that one needs to know when—and when not—to use it. Yes, there are decisions and follow-on actions which require exacting precision and will override the costs I have mentioned. Precision, which demands extraordinary levels of attention, is an expensive proposition. But, space shuttle flights, surgery, and safety—to mention but a few—are worth the extra effort.

If I was an astronaut, the 20/80 rule would not be the best approach. It would not be a comforting feeling for me as I sat on top of a NASA rocket in its countdown phase. Nor would I feel comfortable getting ready for open heart surgery based on the 20/80 rule. Likewise, strategic, long-range decisions made by leaders which impact on national and world stability demand near fail-safe considerations. However, despite these exceptions, the vast majority of decisions will fall within the 20/80 rule.

Bottom Line

Combining the economic principles of opportunity costs, time value and diminishing returns with basic leadership traits provides us with a simple formula for successful decision making. Called the "20/80 rule," the process encapsulates practical leadership. It focuses on meeting less-than-absolute standards of performance while maintaining realistic momentum. It is a handy rule of thumb which emphasizes the idea of "in-stride" net gains in decision making. In short, it is practical leadership!

Colonel Harback is commander and district engineer of the Louisville District, Corps of Engineers. He previously served as commander of the 14th Engineer Battalion (Corps), Fort Ord. He has served in various command and staff positions, including executive officer, Bayonet Combat Support Brigade, 7th Infantry Division (Light); deputy commander, 7th Engineer Brigade, VII Corps; S-3, 7th Engineer Brigade, and aide-de-camp to the commanding general, U.S. Army Western Command. He is a graduate of the Army War College.

Endnotes:

[1] *Taking Charge: A Practical Guide for Leaders*, Perry M. Smith, p. 108.

[2] *Small Unit Leadership: A Common Sense Approach*, Dandridge M. Malone, pp. 126-129.

[3] Field Manual 25-100, *Training the Force*, U.S. Department of the Army, pp.1-5.

[4] Field Manual 22-103, *Leadership and Command at Senior Levels*, U.S. Department of the Army, p. 82.

[5] *Economics*, Paul A. Samuelson, pp. 21-26.

[6] *Ibid*, p. 761.

[7] *What is Economics?*, Jim Eggert, pp 8-10.

[8] *Why Leaders Can't Lead: The Unconscious Conspiracy Continiues*, Warren Bennis, p. 22.

Engineer Solution

1. Determine the length of the vertical curve required to clear the pipeline, with 4 feet of minimum cover at the road centerline.

a. The first part of the problem requires a vertical curve to be designed through a known point. The pipeline is located at STA 15+20, so you must find the grade line elevation (GLE) for that station. Or, you can find the change of elevation in 80 feet on a 8.6 percent grade:

$$\frac{8.6}{100} \times 80 = 6.88 \text{ feet change}$$

$$\text{GLE} = \text{PVI Elev} + 6.88 = 1011.00 + 6.88 = 1017.88 \text{ (STA } 15 + 20)$$

The elevation at the top of the pipeline is 1017.00, and the required centerline elevation is 1017 + 4 feet of minimum cover, or 1021.00. Therefore, the minimum offset (OFF) between the minimum final grade and the GLE is:

$$\text{OFF} = 1021 - 1017.88 = 3.12 \text{ feet.}$$

This figure becomes the known point.

b. When the known point is at a location other than the PVI, use the following equation to determine the length of the curve:

$$L = 2 \times \left[\frac{A + 2(OFF)}{\Delta G}\right] + 4\sqrt{\frac{A(OFF)}{\Delta G} + \left(\frac{OFF}{\Delta G}\right)^2}$$

Where:

A = horizontal distance, in feet, from the PVI to the known point

ΔG = absolute decimal value of $G_1 - G_2$ or $\Delta G = |G_1 - G_2|$

OFF = offset between the elevation of the known point and the GLE of the known point

Solve for A:

$$A = \text{PVI} - 15 + 20 = 16 + 00 - 15 + 20 = 80 \text{ feet}$$

Solve for ΔG:

$$\Delta G = |G_1 - G_2| = |-0.086 - 0.040| = 0.126$$

Solve for OFF:

$$\text{OFF} = 1021.00 - 1017.88 = 3.12$$

Engineer Solution

c. Enter the GLE values into the table.

	STA	GLE	Offset θ	Road Elevation
PVC	13 + 50	1032.50		
	14 + 00	1028.20		
	14 + 50	1023.90		
	15 + 00	1019.60		
Pipeline	15 + 20	1017.88		
	15 + 50	1015.30		
PVI	16 + 00	1011.00		
	16 + 50	1013.00		
Low Point	16 + 91	1014.64		
	17 + 00	1015.00		
	17 + 50	1017.00		
	18 + 00	1019.00		
PVT	18 + 50	1021.00		

d. Next, determine the offset (θ) from the grade line elevation up to the road centerline elevation using the equation:

$$\theta = \frac{\Delta G \ (d)^2}{2L}$$

Where:

d = distance from the point of vertical curvature (PVC) or PVT to the station.

Remember: When d values are identical, the offsets are the same on both sides of the curve. After you have solved the $\Delta G/2L$ portion of the equation, that value (1.26) remains constant.

θ 13 + 50 = $1.26\,(0.0)^2$ = 0

θ 14 + 00 = $1.26\,(0.5)^2$ = 0.32

θ 14 + 50 = $1.26\,(1.0)^2$ = 1.26

θ 15 + 00 = $1.26\,(1.5)^2$ = 2.84

θ 15 + 20 = $1.26\,(1.7)^2$ = 3.64

θ 15 + 50 = $1.26\,(2.0)^2$ = 5.04

θ 16 + 00 = $1.26\,(2.5)^2$ = 7.88

θ 16 + 50 = = 5.04

θ 16 + 91 = $1.26\,(1.58)^2$ = 3.15

θ 17 + 00 = = 2.84

θ 17 + 50 = = 1.26

θ 18 + 00 = = 0.32

θ 18 + 50 = = 0.00

Engineer Solution

Now, determine L:

$$L = 2 \times \left[\frac{80 + 2(3.12)}{0.126}\right] + 4\sqrt{\frac{80(3.12)}{0.126} + \left(\frac{3.12}{0.126}\right)^2}$$

$$= 2 \times [80 + 49.52] + 4\sqrt{1980.95 + 613.15}$$

$$= 259.04 + 4(50.93)$$

$$= 462.76$$

The minimum length of the curve = 462.76 feet.

Answer: Using the round-up rule to the next even 100 feet, the length of the curve L = 500 feet.

2. Determine the low point.

When tangent grades are unequal and have opposite signs, the low point *always* occurs on the flatter of the two grades. Therefore, the low point will fall between the PVI and the point of vertical tangency (PVT) on the side with the 4.0 percent grade.

Use $$x = \frac{L(G)}{\Delta G}$$

Where:

X = distance to the low point from the PVT, and

G = flatter of the two grades, then

$$x = \frac{5(4)}{12.6} = 1.59 \text{ STA, or } 159 \text{ feet}$$

PVT = PVI + L/2 = 1600 + 500/2 = 1850 or STA 18 + 50

Low point = PVT - x = 1850 - 159 = 1691 or STA 16 + 91

Answer: The low point of the curve is at Station 16 + 91.

Engineer Solution

3. To stake the centerline, the surveyors will need the stationing and centerline elevations.

a. The first step is to set up a table, as shown below. Enter the known information, and solve for each station's GLE and offset (θ).

	STA	GLE	Offset θ	Road Elevation
PVC	13 + 50			
	14 + 00			
	14 + 50			
	15 + 00			
Pipeline	15 + 20	1017.88		
	15 + 50			
PVI	16 + 00	1011.00		
	16 + 50			
Low Point	16 + 91			
	17 + 00			
	17 + 50			
	18 + 00			
PVT	18 + 50			

b. Determine the GLE for each station using the equation:

$$GLE = PVI\ Elev + |G|\ d$$

13 + 50 GLE = 1011.00 + 8.6 (2.5) = 1032.50
14 + 00 GLE = 1011.00 + 8.6 (2.0) = 1028.20
14 + 50 GLE = 1011.00 + 8.6 (1.5) = 1023.90
15 + 00 GLE = 1011.00 + 8.6 (1.0) = 1019.60
15 + 20 GLE = 1011.00 + 8.6 (0.8) = 1017.88
15 + 50 GLE = 1011.00 + 8.6 (0.5) = 1015.30
16 + 00 GLE = GIVEN = 1011.00
16 + 50 GLE = 1011.00 + 4.0 (0.5) = 1013.00
16 + 91 GLE = 1011.00 + 4.0 (.91) = 1014.64
17 + 00 GLE = 1011.00 + 4.0 (1.0) = 1015.00
17 + 50 GLE = 1011.00 + 4.0 (1.5) = 1017.00
18 + 00 GLE = 1011.00 + 4.0 (2.0) = 1019.00
18 + 50 GLE = 1011.00 + 4.0 (2.5) = 1021.00

Engineer Solution

e. Enter the offset values into the table. Add the offset value to the GLE. The resulting sums are the final centerline road elevations.

	STA	GLE	Offset θ	Road Elevation
PVC	13 + 50	1032.50	0	1032.50
	14 + 00	1028.20	0.32	1028.52
	14 + 50	1023.90	1.26	1025.16
	15 + 00	1019.60	2.84	1022.44
Pipeline	15 + 20	1017.88	3.64	1021.52
	15 + 50	1015.30	5.04	1020.34
PVI	16 + 00	1011.00	7.88	1018.88
	16 + 50	1013.00	5.04	1018.04
Low Point	16 + 91	1014.64	3.15	1017.79
	17 + 00	1015.00	2.84	1017.84
	17 + 50	1017.00	1.26	1018.26
	18 + 00	1019.00	0.32	1019.32
PVT	18 + 50	1021.00	0	1021.00

Answer: - There are 4.52 feet of cover over the pipeline at STA 15 + 20.
- The low point is at STA 16 + 91.
- The final centerline elevations are shown in the table above.

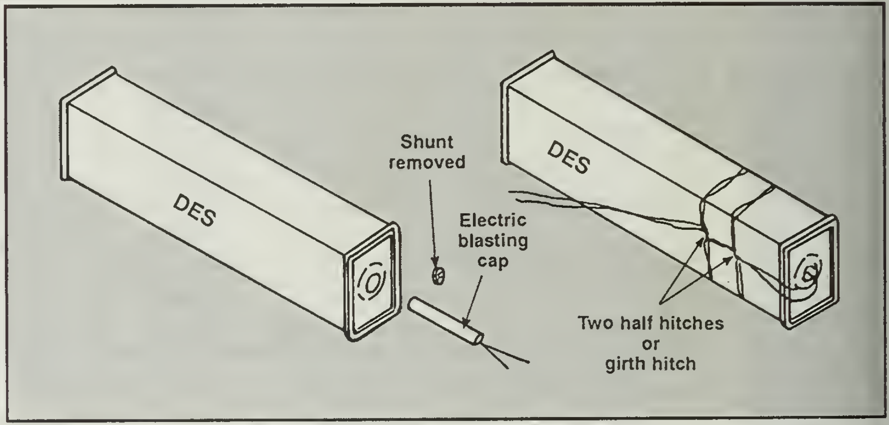
This Engineer Problem/Solution was submitted by the Roads and Airfield Branch, Combat Construction Division, Department of Instruction, U.S. Army Engineer School.

ENGINEER UPDATE

Commercial numbers are (314) 563-XXXX and Defense System Network (DSN) numbers are 676-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

Demolitions Effects Simulator (DES). To provide realism in demolitions training, a locally fabricated device, number DVC-D 05-46, was approved for Army-wide use in April 1991. The DES is a folded, weather-resistant cardboard trainer that simulates the M5A1 demolition charge. The trainer is filled with a mixture of 50 percent chalk and 50 percent sand. When detonated with a blasting cap or detonation cord, it produces a flash, bang, and smoke signature. For a complete information package, call CPT Bart Ives, -7805. Local Training Aids Support Centers (TASCs) will produce them upon request.



Demolitions Effects Simulator (DES)

FY93 Self-Development Tests (SDT) for MOS 62B. The MOS-specific portion of the FY 93 SDT for MOS 62B soldiers has been revised. Questions related to basic task information that do not require extracts will replace questions based on material provided in extracts from doctrinal manuals. The new questions have had two reviews by NCOs and draft test administrators. Validation confirmed that soldiers should not require references to answer the new questions. To maximize their opportunity for high test scores, 62B NCOs are encouraged to begin their study programs as soon as they receive the FY 93 SDT Notice. POC is Jim Evans, -7510.

Leadership Videodisc Program Available. A user-friendly practical exercise is available to students preparing for leadership positions. Titled "Task Force Engineer in Defensive Operations I and II," the interactive videodisc (IVD) allows students to act in battalion task force engineer and combat engineer platoon leader positions. The program, IVD 5-1, is available to Active and Reserve Component units through local TASCs and state adjutant general offices. POC is Suzanne Rosen, -7645.

Directorate of Combat Developments (DCD)

VOLCANO Light Approved for Development. The VOLCANO, a multiple delivery mine system, is slimming down to meet the needs of light units. The mounting system will be modified to provide light forces an effective force multiplier in light intensity conflicts. The current

VOLCANO mine system consists of four racks, each with 40 mine canisters, and a dispenser control unit. Two variations will be available for VOLCANO Light: A single rack to be mounted on an M998 high mobility multi-purpose wheeled vehicle (HMMWV) will be issued as a weapon. A portable model with a single canister equipped with a built-in firing device will be issued as a Class V item (like a claymore). The estimated fielding date is 1997. POC is SFC Thomas Adams, -7327.

TRADOC Project Office Update. In a June 10 letter from the Under Secretary of Defense, the Armored Systems Modernization (ASM) program was redirected. This effectively deferred the Combat Mobility Vehicle (CMV) ielding and limited its design impact. The letter stated "The Army should continue to consider commonality for future vehicles at the component level as a design parameter. However, other vehicles (CMV) have been deferred o the extent that this should no longer be a fundamental design driver."

Both of the engineers' M1-based mobility systems, the Breacher and he Heavy Assault Bridge (HAB), remain on schedule. The Breacher program passed Milestone I on 13 May, and was granted approval to levelop 106 vehicles. Current plans call for a contract award by 1 October 92, with fielding commencing in FY 99. The HAB special in-process eview on 25 June validated the program acquisition strategy. The current chedule calls for fielding 106 HABs beginning in FY 98. POC is MAJ och or Al Lee, -7326.

Directorate of Evaluation and Standardization (DOES)

ENGINEER *Readership Survey.* Randomly selected units from *EN-GINEER* Professional Bulletin's mailing list will soon receive readership urveys. Those receiving surveys are urged to complete and return them ithin two weeks of receipt. This is your opportunity to assess the bulletin nd tell the staff what you would like to read in future issues. Comments nd suggestions are welcome. POC is Peggy McAvenia, -5305.

Unexploded Ordnance. The issue of unexploded ordnance (UXO) und in the Gulf War has attracted national media attention. The authors a Lessons Learned article that appeared in the February 1992 issue of *NGINEER* (p. 28-30) stand by their comments. The article was written to dvise soldiers of the dangers inherent with unexploded munitions, and e techniques recommended in it are recognized methods of minimizing ose dangers in training and on the battlefield. The first sentence of the oto caption on page 29, however, is incorrect. The munitions are identified munitions found by combat engineers from the 18th Corps irborne). POC is Vern Lowrey, -5304.

Department of Instruction (DOI)

Training Needs Identified. The combat training centers (CTC) have entified two areas where engineer officers require additional training. e first, terrain analysis, is critical in the combined arms arena. The TCs report that engineers' skills in terrain analysis are weak, and that gineers need more practice and experience in determining terrain impacts on tactical operations. As the terrain experts, engineers must help their commanders visualize the terrain and be able to explain how it will affect the mission. Terrain walk exercises, tactical exercises without troops, and officer professional development classes can be used to strengthen these skills.

The CTCs also report that engineers working at the main command post often do not develop threat templates for their planning. Developed with the help of the intelligence staff, the templates are used to identify places most likely to contain threat activity. Engineers and intelligence staff use the templates to set up and focus their reconnaissance and surveillance (R&S) plans, and to determine breaching asset and personnel requirements. Units are encouraged to use the method taught at the Engineers Officers Advanced Course to develop proficiency in preparing threat templates. POC is CPT Bob O'Brien, 3-5519.

Engineer Personnel Proponency Office (EPPO)

Advanced Civil Schooling. Each year the Engineer Branch at PERSCOM selects officers to attend civilian graduate schools on a full-time basis. Those selected normally attend school for 18 months to obtain advanced degrees that will enable them to fill positions validated under the Army Educational Requirements System (AERS). Graduates are required to serve in an AERS position for a minimum of three years. Most of these positions are in the fields of civil, construction, environmental, structural, or topographic engineering. To satisfy Corps of Engineer position requirements, EPPO and PERSCOM are working together to identify acceptable universities (in terms of programs of instruction, tuition, etc.) for engineer officers to attend. Program requirements are in AR 621-1, Chapter 3, dated 15 October 85. POC at Engineer Branch is CPT Chamberlain, DSN 221-7504. POC at EPPO is CPT Brad Eaton, -5362.

News and Notes

FM 25-101 Improvements Requested. Combined Arms Command-Training (CAC-TNG), Fort Leavenworth, is requesting suggestions on how to improve training management doctrine in FM 25-101, *Battle Focused Training.* Suggestions for text changes and additions should include the specific page/paragraph and specific recommendation. Submit comments by December 1992 to: Deputy Commanding General for Training, Combined Arms Command, Attn: ATZL-CTT, Fort Leavenworth, KS 66027. POC is CPT Bill Hedges, (913) 684-3919, DSN 552-3919.

Prime Power Production Specialist Course. Looking for a career that will give you hands-on engineering experience with electrical power generation and distribution systems? The Army's prime power program offers this opportunity, plus travel throughout the world. The MOS is open to soldiers who are in grade E-5 and below, agree to serve three years after completing training, have GT/ST and EL scores of 110 or higher, and pass the basic math and science proficiency test. The next course begins 1 February 1993, with students reporting on 19 January. Applications are due at PERSCOM by 30 September 1992. POC is Ms Martineau, (703) 704-1505/1507.

Army Engineering:

A Key to National Greatness

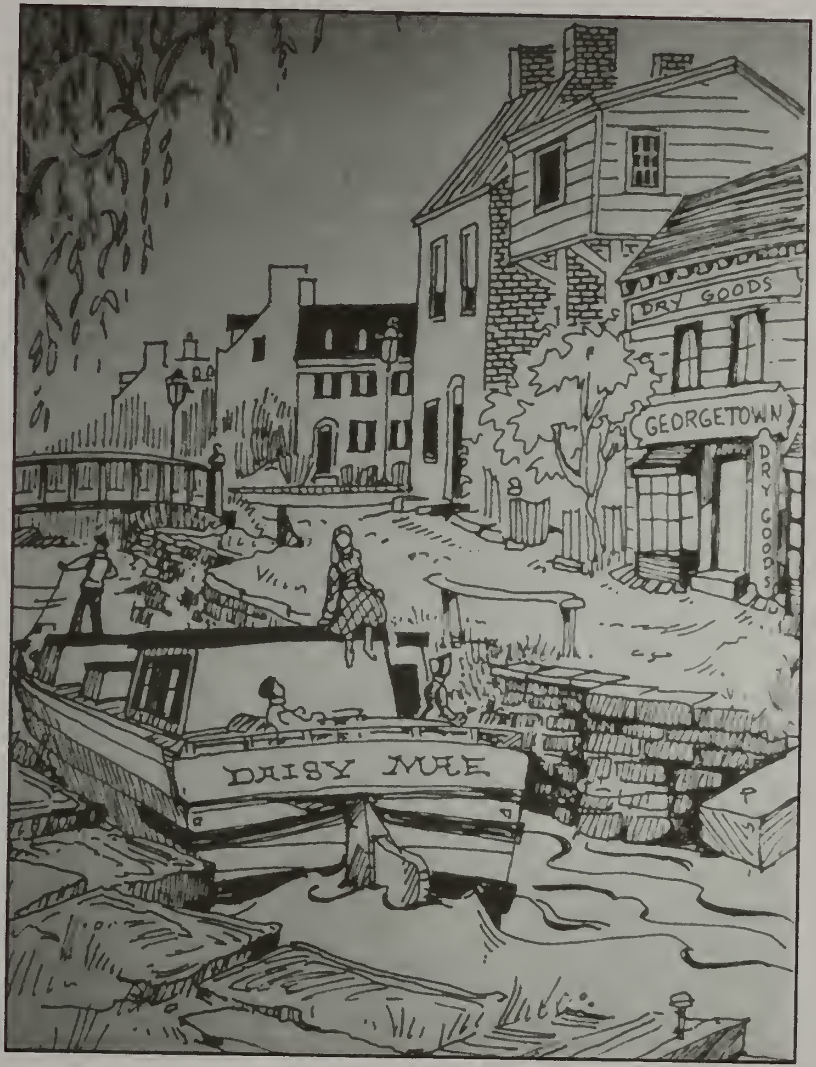
By Dr. Martin Reuss

When Army engineers first became involved in public vorks construction in the early 9th century, they immediately hought of themselves as "nation uilders"—as engineers making valuable, necessary contribuion to national greatness. Intead of simply constructing a etwork of roads and waterways, he Corps wanted to construct rojects that would last for the ges.

Critics accused them of overenineering, of constructing grand orks when something less amitious and costly (even if less safe nd durable) would suffice. This redilection to turn public works rojects into what some perceived s engineering monuments conibuted to charges in the early 9th century that Army engineers ere a new aristocracy at variance ith democratic virtues.

Similar charges have been eard recently, although now they e based as much on environmenl as on financial concerns. The uth is that the Corps' cost esmates have always leaned ward the conservative side, emhasizing safety and durability. It true, however, that Army enneers believe their projects conibute to national greatness and e something more than just e more link in America's inastructure.

An instructive example is the hesapeake and Ohio Canal along e Potomac River. Army enneers surveyed the route for the &O Canal in the late 1820s and advised building it all the way to Pittsburgh. The estimated cost was about $22 million, an enormous sum for that time. They justified the figure by noting, "When a nation undertakes a work of great public utility, the revenue is not the essential object to take in consideration: its views are of a more elevated order—they are all, and, it may be said, exclusively, directed toward the great and general interests of the community."



A drawing of the C&O Canal at Georgetown in the late 1850s.

According to those engineers, any revenues derived from the canal (a matter of considerable interest to the canal company) were "...of merely secondary importance for the nation." The Army engineers designed a canal that would testify to the glory of the nation, even though it saddled the canal company with enormous

Mules were used to pull boats through the the C&O Canal. This photo probably was taken around 1900.

debt. Just the first part of the canal, stretching 184 miles from Washington, D.C. to Cumberland, Maryland, would cost nearly $9 million according to Army estimates.

Outraged investors and politicians called for another survey, this time by a group of engineers led by two who had worked on the Erie Canal. These gentlemen craftsmen, much admired but ignorant of formal engineering theory, determined that the canal to Cumberland could be built for less than half the Army's estimate. They cut the width from 60 to 40 feet, left the bed of the canal unlined, and estimated excavation costs to be about 5 cents per cubic yard, compared to the Army's estimate of 14 cents per cubic yard. Congress, investors, and state and local officials were delighted, and construction got underway.

But when the canal to Cumberland was finally completed in 1850, the cost was more than $2 million higher than the Army's estimate. Chastised directors of the canal company harkened back to the beginning of the project and explained, "A body of men, however upright and intelligent, are easily satisfied of what they greatly wish to believe. The elaborate, well digested, and disinterested estimates of a corps of the ablest engineers in America guided by the matured experiences of one who had distinguished himself at the [French] Polytechnic school [BG Simon Bernard]...were thus cast aside and condemned."

Disregarding the question of who the best engineers were, we see a kernel of truth in the charges of overengineering. "We were planning a work for the nation," wrote Army engineer officers in their 1826 report on the C&O Canal, and "it did not belong to us to curtail the cost in order to derive from the capital a greater interest...to the detriment of durability and conveyancy." The Corps of Engineers thought in terms of grand works of improvement that would knit together the new nation, promoting both political stability and commercial development. In this, engineer officers revealed the French bias of their West Point training, for state owned and constructed roads and canals in France had contributed much to that country's military security and economic progress.

What these industrious, educated, and dedicated Army officers could not have appreciated was that they were establishing a sense of administrative responsibility that remains with the Corps to this day. They elevated the construction of roads and canals from an engineering and financial exercise—enough to satisfy the ambitions of most civilian engineers—to an enterprise that both symbolized and contributed to national grandeur and strength.

In today's environment, with conflicting and numerous demands on limited funds, Army engineers are far more sensitive to financial constraints. Nevertheless, the emphasis on the value, indeed the necessity, of a transportation network for national greatness remains part of the culture of the Corps of Engineers. When Army engineers claim they have a role to play in repairing and replacing America's infrastructure, they use as evidence nearly two centuries of experience in building a nation and, in so doing, contributing to its strength and unity.

Dr. Martin Reuss is a Senior Historian in the Office of History, Headquarters, U.S. Army Corps of Engineers, at Fort Belvoir.

BRIDGE THE GAP

By Command Sergeant Major Richard N. Wilson
U.S. Army Engineer School

> *"Safe training is a predictable result of performing to established tactical and technical standards. Leaders at all levels ensure that safety requirements are integral, not add-on considerations, to all aspects of planning, executing, and evaluating training. Safe training results from the systematic management of inherently dangerous training risk."*
>
> (*FM 25-100,* Training the Force)

Both FM 25-100 and FM 25-101 *(Battle Focused Training)* emphasize the need to integrate (not add on) safety into training and to perform to standards. The same message appears in FM 100-5, *Operations,* which stresses force protection. One of he four elements of combat power, force protection as two components: protection from enemy actions, nd the protection of personnel and equipment from oss or damage. Safety is part of the second comonent and must be integrated into all activities, in eace and in war.

Over the history of the U.S. Army, accidents acount for 20 percent of the casualties and 40 percent f materiel losses. In the most recent conflicts Grenada, Panama, and Desert Shield/Storm), losses om accidents (excluding fratricides) have aproached 50 percent. We must work to improve that atistic!

As engineer soldiers, safety is especially impornt because we are constantly on the move: going and from field training exercises, construction tes and ranges; and participating in sports acvities and other functions. Because engineers are onstantly called on to do more with less, we somenes try to do too much, both on and off duty. hile our intentions may be good, we fail to recogze the danger in which we place ourselves and ur soldiers.

Many accidents can be reduced or prevented if all vels of leadership understand and implement effece risk management. Risk management is a tool leaders use to integrate safety into training. We cannot stop training or fail to perform a mission in combat simply by using safety as an excuse. Nor can we afford to unnecessarily jeopardize the lives of our soldiers or the loss of critical equipment, which could affect mission accomplishment. However, studies show that by using risk management techniques, units can improve training safety by 50 percent.

The Army has not adopted any one format as a standard for the risk assessment portion of risk management, even though many are available. The exact format used will be dictated by local policy. Regardless of the format, the basic process remains the same: Identify risks, assess risks, develop controls and make decisions, implement controls, and supervise.

No matter how we assess risks and establish safety programs, the enforcement of standards is critical. Enforcement is a primary leadership responsibility—every soldier is responsible for enforcing the standards. Ironically, most organizations have established excellent standing operating procedures (SOPs), but they often fail to ensure that the standards are enforced.

Any time that we fail to enforce an existing standard, we set a new standard and we set our soldiers up for failure. The majority of all accidents can be traced back to the violation or non-enforcement of a known, well established standard. When soldiers are not trained to standards and standards are not enforced, the effectiveness of that unit is diminished and the risk to soldiers is greatly increased. Statistics show that 80 percent of all accidents are caused by human error, and supervision is key to preventing human error.

As FM 25-100 states, we as leaders must train to and enforce all standards at all times. That is how we can really "protect the force." Our commandant puts it another way: "Train Combat Hard, Train Combat Realism, Train Combat Safe." Make that your motto!

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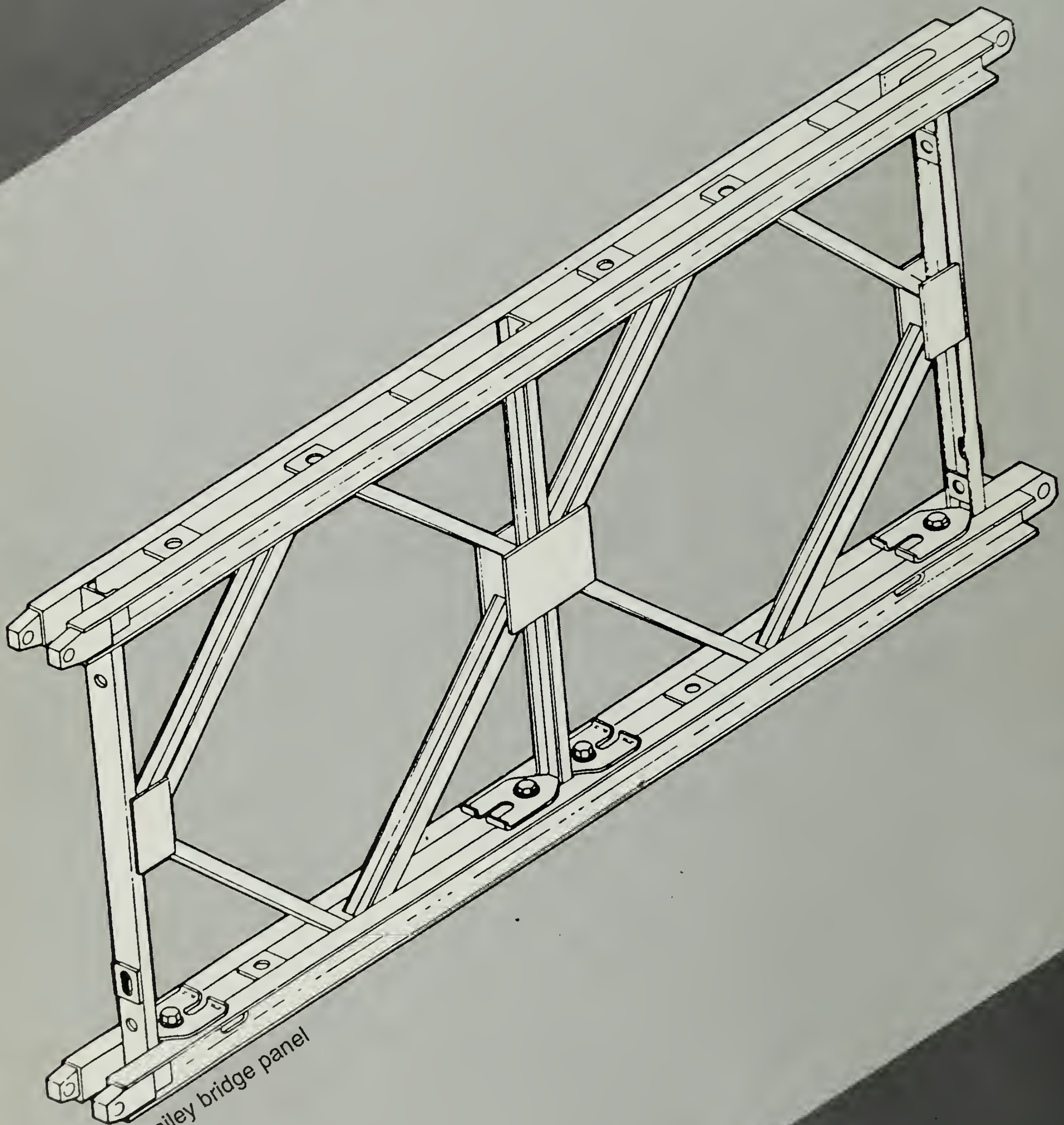

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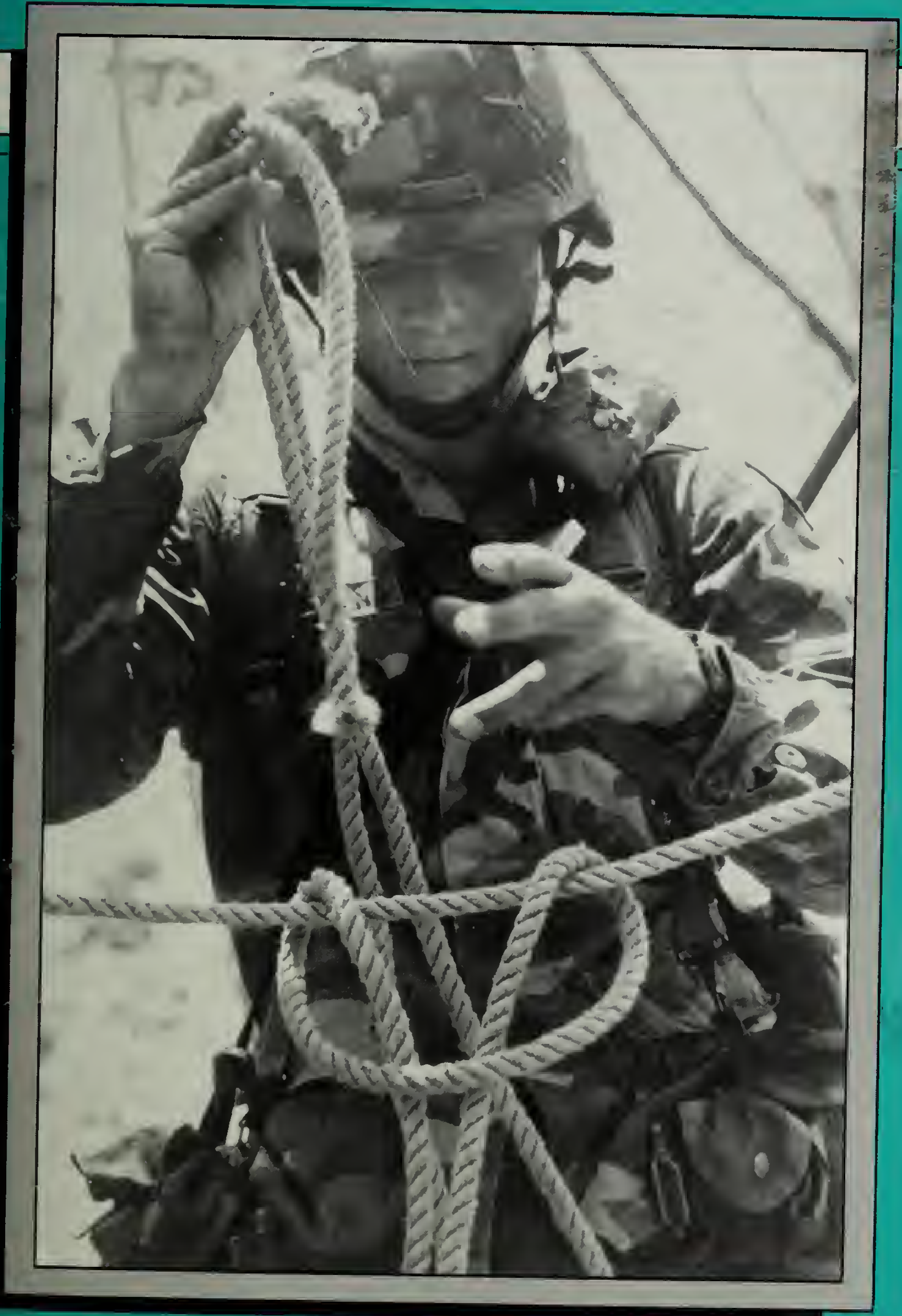

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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

In today's climate of change, the Engineer School continues to be a proactive force. We are committed to addressing issues that will allow engineers to meet the demands of a downsized Army.

In an effort to rapidly implement emerging technologies, TRADOC has recently formed six Battle Labs. The six labs (Dismounted Battle Space, Mounted Battle Space, Depth and Simultaneous Attack, Battle Command, Early Entry, and Combat Service Support) will define high payoff requirements for the conduct of future operations. Each lab, operating within the structure of the Concepts Based Requirements System, will collect and examine ideas and technology, refine requirements, and generally serve as a fertile environment for fast-track developments. The Engineer School has formed a cell, headed by Colonel Wy Leadbetter, to support the Battle Lab effort and ensure that engineer combined arms initiatives receive maximum visibility.

In August we presented the Engineer Functional Review, which is a comprehensive personnel wrap-up, to the Deputy Chief of Staff for Personnel, Lieutenant General Thomas P. Carney. The Engineer Functional Review was a precursor to the Engineer Functional Area Assessment (FAA), which was presented to the Vice Chief of Staff in October. We used the FY 92 FAA to examine the impacts of downsizing and restructuring the engineer force through the next several years. My focus was on equipment modernization, an area which has been "broken" for years. Will give you a complete update on FAA details in the next edition of *ENGINEER*.

Regarding another personnel issue of concern, a Presidential Commission convened to address the assignment of women in the Armed Forces. To that end, Commissioner Herres, General (Retired) U.S. Air Force, asked for my views on this subject. After gathering data and speaking with commanders in the field, as well as a broad cross section of women, I have concluded that all positions in the Engineer Branch should be opened to women. I know this is a tough call, but our female soldiers must be afforded full opportunity to pursue careers in the military. I would like to share with you the views I forwarded to the commission. My testimony, provided in full, begins on page 2.

The preliminary draft of FM 100-5, *Operations*, was released in September (distribution of the final field manual is scheduled for May 1993). The new manual will reflect an evolutionary, not revolutionary, change in Army doctrine: AirLand Battle doctrine in the 1986 version remains relevant. Changes, for the most part, will reflect changes in our environment and a desire to extend capstone doctrine into areas not emphasized previously.

The manual describes the Army as a force projection Army, fully integrated into joint operations, and often participating in battle as part of a coalition. Success is described as a Total Army achievement—Active, Reserve, and civilians. Doctrine emphasizes the concept of "balance:" a balance of armored, light, and special operating forces; balance between the offense and defense; and balance between fire and maneuver. New ground is broken in discussions of "operations other than war."

Publication of the 1993 FM 100-5 will require revisions in other doctrinal manuals, including FM 101 5, *Command and Control of Commanders and Staff*, and FM 5-100, *Engineer Operations*.

Finally, some lessons learned from Hurricanes Andrew and Iniki. The scope of the storms' devastation was enormous, and getting engineer teams on the ground early to assess the damage was critical. U.S. Army Corps of Engineer districts and local offices were well prepared for early response, and Army engineers are playing a vital role in assisting with the clean-up efforts. Much of the engineer effort has been horizontal and tested our hauling and loading capabilities. Hard engineering skills and the development of contingency plans to support natural disasters, however, are areas where engineers need to improve. Suggest you read Chapter 3 of FM 5-114, *Engineer Operations Short of War*, which provides procedures for supporting disaster relief efforts. Will provide additional feedback on this important mission area in forthcoming issues of this bulletin.

As always, engineers are at the forefront of changes occurring within our Army. We will stay in front if we focus on quality support to the combined arms team and to all our customers; we must truly function as "One Army," Active, Reserve, and civilians alike. ESSAYONS!

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Cover: Second Lieutenant Gene Freeland ties one of seven required knots during a sapper test.

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MG Daniel W. Christman's Testimony to:

Presidential Commission on the Assignment of Women in the Armed Forces

Mr. Commissioner, distinguished members of the Commission. Deeply appreciate the opportunity to submit testimony to this commission. I fully understand the importance and the sensitivity of the issues you have asked me to address. Previous witnesses from my service have attested to the commitment all of us in the Army share to provide the best opportunity for our female soldiers. I share fully in that commitment. I would like to offer some perspectives from my position as branch chief for a significant combat arms branch of our Army—the Corps of Engineers—where females are currently permitted to serve.

Would like first to give you a brief personal background on my earlier assignments, and then outline the situation prevailing today in my branch with respect to assignment of female soldiers. I then intend to outline steps I have taken to open, within practical limits, additional positions in the engineers for women. I'll close with a specific recommendation regarding the most difficult assignment issue—the role of women in those units at the "point of contact" for the land battle and what, if anything, I would do beyond those steps I initiated this spring for female engineer officers.

By way of background, I am the Commanding General of the Army's second largest basic combat training installation. Although our primary day-to-day mission is in the training arena, we also are the home for several Table of Organization and Equipment (TOE) units belonging to the Army's Forces Command. Fort Leonard Wood became the home four years ago for the combat engineer branch, and at our engineer schoolhouse we are currently training 896 engineer officers and noncommissioned officers (NCOs), of which 102 are women. In addition, we are training 9,547 initial entry soldiers, of which 1,906 are women. Of the 16,220 soldiers currently assigned to Fort Leonard Wood, 2,700 are women. At the Engineer Center w also have roughly 2,100 civilian employees, 55 percent of whom are women.

My previous command positions in the Army involved company and battalion commands in Korea Vietnam and Germany; each of these was an all-male organization. At the full colonel level, I commanded the Savannah District, United States Army Corps of Engineers, an organization composed primarily of civilians; approximately 33 percent of the 1,100 employees at Savannah were women.

As branch chief, the issue of female career oppo tunities, particularly for female officers, has been front burner issue for me since I assumed command of the Engineer Center. Roughly five percen of our Active Component officer corps is female, and although the vast majority of our officer, NCO and enlisted positions are open to females, particularly for the grades of major and above, a significant number of positions remain closed. This generally involves service at battalion level and below for the divisional and corps combat enginee battalions of our TOE Army.

Although promotion opportunities for women in my branch are roughly comparable to their male counterparts, very few women are currently found in the Corps of Engineers at grades above captain The decline in the percentage of women represented at each grade level in the engineers is refle tive of the broader Army situation: Army-wide, females represent 21 percent of lieutenants but this percentage declines to only 3 percent at the grade of colonel; in the enlisted grades, 13 percent of the privates are female, but the number falls to

2 percent at the sergeant major level.

The situation outlined above is exacerbated for our Active Component engineer officers by planned reductions in Army end strength which affect certain engineer units disproportionately. Army combat heavy engineer battalions, for example, will be significantly reduced in the outyears. Those units have traditionally been the source of greatest lieutenant, captain, and junior major experiences which qualify young female officers for promotion to lieutenant colonel and battalion command. Taken together, in projecting engineer end strength through 1996, the percentage of "key troop positions" (platoon leader, company commander, battalion executive officer, battalion S-3, etc.) open to females will be reduced at the captain level from 35 to 31 percent; at the major evel the reduction will be from 32 to 29 percent. ronically, this will occur while female strength increases within the branch. While male strength is projected to decline by 31 percent, female strength will actually increase by nine percent between now and 1996. Additionally, would like to point out that he number of women entering command age is inreasing exponentially, with little accommodation in ncreased opportunity.

That completes a quick review of the personnel data for my branch. A complete picture of the branch, however, requires more than data; it requires a look as well at attitudes and outlooks. Thus, I must also share with you *perceptions* of female officers within the Corps. I have spoken to female cadets at West Point who chose the engineers as a branch, and to many female lieutenants and captains who are assigned as students at Fort Leonard Wood in the Engineer Officer Basic and Advanced courses and as permanent party cadre. From this group emerges a clear perception that career advancement potential is seriously constrained given current assignment policies which prohibit service in combat battalions. Even though senior positions are open to women, females sense they cannot qualify for those positions through branch assignments at lieutenant and captain levels. As a result, many leave the military following their initial periods of obligated service. This perception is perhaps best reflected in the words of one young officer, who wrote to our school recently about assignment policies. Her words are typical of the views of many in our branch: "Opportunities for female engineer officers have followed a roller-coaster path. Stop coding positions; either completely open or completely close branches." The view of female officers at Fort Leonard Wood on this issue is almost unanimous: open the branch now, and open it completely.

In view of these conditions, last spring I directed that additional positions, heretofore closed to females, be opened to women at the first opportunity. These included company command positions for bridge companies as well as staff positions in the newly formed engineer brigades that were created internal to each mechanized and armored division. This decision had a significant and positive impact on authorized positions open to females. At the lieutenant and captain grades, opportunity will increase markedly rather than decrease as previously projected; field grade positions will remain essentially unchanged rather than decrease; and "key troop leading positions" will be expanded significantly. The chart (page 4) summarizes the impact of these changes. Although Table of Distribution and Allowances positions are gender neutral, women are precluded from service in some units at Fort Leonard Wood due to previous military occupational specialty (MOS) documentation. I issued guidance to review these positions and make changes to open to the maximum extent possible all positions to females.

These are limited first steps. Engineer branch is a popular branch among females because of the high percentage of our career fields open to

Engineer Officer Corps Key Troop Positions Percentage Open to Females*

	LT	CPT	MAJ	LTC	COL	Total
FY 91	24	35	32	43	89	29
FY 96	21	31	29	36	43	26
FY 96 Modified	27	39	43	36	43	33

*Includes Platoon Leader, Company Commander, BN XO, BN S-3, ADE, Bde Engineer, Bn Commander, and Brigade/Group Commander

women—24 of our 29 enlisted MOS and all of our officer and warrant officer specialties are open in whole or in part. I want to maintain this branch enthusiasm, and consequently there is much more I would prefer to do. However, as previous Army witnesses have explained, the combat engineers are not independent actors on the battlefield. We operate as a member of a tightly knit combined arms team. Thus, I am reluctant to open positions at the level of combat battalion and below until positions in those branches with whom we most closely interact—infantry and armor—are also opened to females. For the time being, I agree that these branches—and only these branches—should remain closed. I recognize there is ongoing debate on the impact of an immediate opening of positions in these units to women. One approach I favor—although fraught with the danger of being perceived as yet another delay—is a "field test" for a limited number of units in these branches. Hopefully, the results of such a test can dispel the hysteria associated with the role of women in close combat and provide decision makers with a set of data conducive to objective conclusions. I am convinced we can fabricate such a test using our combat training centers and a limited portion of our TOE force in a way which does not impede the combat readiness of our total force.

Where does this leave the combat engineers? Unfortunately, in a dilemma. Unlike the infantry and armor branches, significant numbers of females are *already* in my branch, as outlined above. My bias is to be inclusive, not exclusive. Success factors in war are training, planning, coordinating, rehearsing, discipline, team effort, and leadership. Female soldiers are already versed in each of these areas and have clearly demonstrated their tactical and professional competence in engineer positions currently open to both sexes. Why ignore this tremendous resource? In this light and in view of the perceptions and frustrations of female engineer leaders regarding career potential outlined earlier, I would urge opening my branch entirely to women. I recognize this places engineers apart from other members of the close combat combined arms team, but I would rather deal with this than perpetuate a "coding" policy which is increasingly difficult to rationalize on the modern, fluid battlefield of precision-guided, deep-strike weapons and simultaneous attacks throughout the depth of the battle area.

We must allow women to have a career in the Corps of Engineers—not just a specific job or assignment today. A large percentage of female engineer officers feel that coding key troop leadershi positions in combat engineer units as "male only" has denied them the opportunity to gain experienc and places them at a distinct competitive disadvantage with their male peers.

We have advanced considerably since 1760 whe our first female soldier, Deborah Sampson, had to impersonate a man to serve her country. We must look to the future and provide women with greate access to career enhancing positions. Patience and perseverance will be needed; instant equality in al branches is not possible for the reasons spelled ou so well by Lieutenant General Peay and others. However, the Army must move beyond the current debate and resolve quickly the issue of female role in our Services. The time spent addressing and readdressing this issue is rapidly preempting othe important matters and serves to accentuate the di tinctions between our male and female soldiers rather than focus on our united aspirations.

One of our Army's goals is to be the premier employer. We can only attain this goal through equal opportunity for all. Know it is a tough call, but it is time to get on with changes so that femal soldiers will be afforded full and equal opportunit to pursue careers in the military.

Appreciate the opportunity to respond to this di tinguished commission.

Reserve Engineer Command:

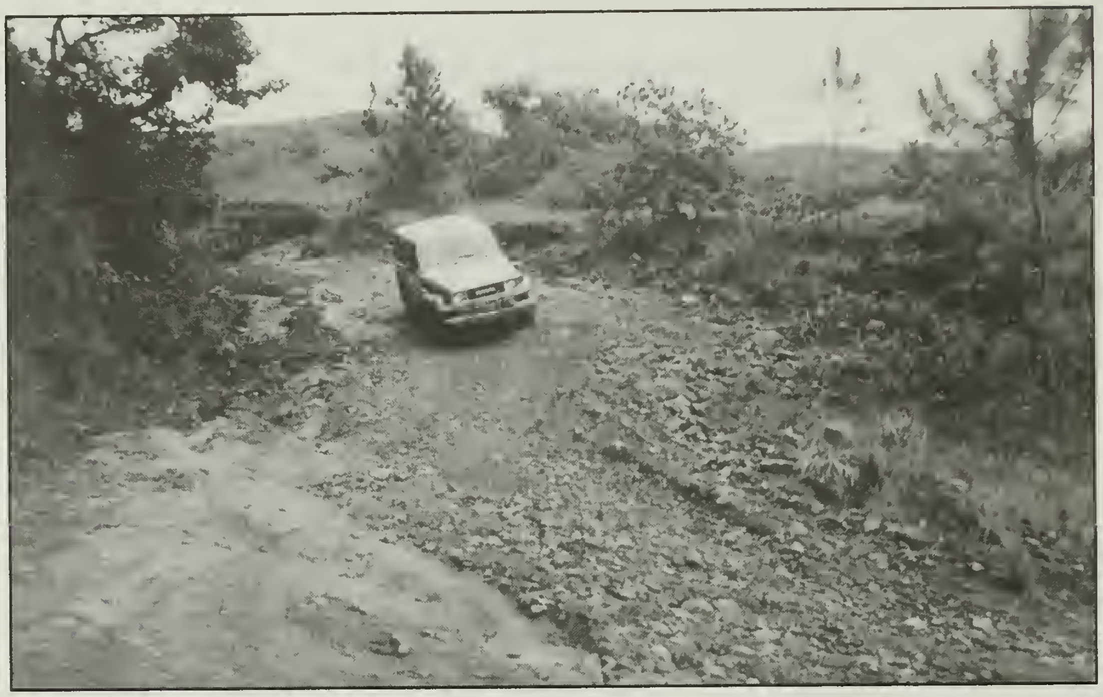
Helping Latin America

By Major Robert R. Bottin, Jr. and Major Jimmy E. Fowler

Engineer teams from the 412th Engineer Command are training in South and Central America in support of U.S. Southern Command (SOUTHCOM). SOUTHCOM's area of operations ranges from the southern border of Mexico in Central America to the southern tip of Chile in South America. American national interests in this theater include preservation of stable, non-repressive, democratic national governments and cessation of illicit drug trafficking in the theater. To achieve these interests, the Department of Defense includes among its objectives the development of nation infrastructure, the detection and countering of narcotics trafficking, and the improvement of professionalism among national security forces.

The 412th, headquartered in Vicksburg, Mississippi, is a major United States Army Reserve Command assigned to Second U.S. Army. It's also a major subordinate command (MSC) of United States Army, Europe (USAREUR) and Seventh Army, and is the Engineer Command for Europe. Commanded by Major General Gene P. Hale, the 412th would command about 50,000 engineer troops on mobilization. Due to its mission, the 412th has been designated a direct deploying unit, the first such unit in the Reserve Components. This means the unit deploys directly to its wartime area of operations without first processing through a mobilization station as other Reserve units do.

Country teams conduct site inspections and prepare work estimates for potential nation assistance projects. Estimates include the manpower, number and sizes of culverts, materials, and equipment needed to complete the project.



Bridges along the routes to potential projects must be classified to ensure equipment and materials can reach the site.

The 412th recently acquired the mission of providing engineer support to SOUTHCOM. SOUTHCOM's need for support coincided with events in world politics which have reduced the unit's opportunities for conducting realistic European engineer-related mission training. The SOUTHCOM mission provides an excellent opportunity for unit training and, at the same time, meets SOUTHCOM's unfulfilled engineer requirements.

The engineer command is acting as an extension of the SOUTHCOM engineer staff and assists in the development of engineer work estimates, engineer annexes to ambassador country plans, engineer construction management plans, and engineer force structure plans. Each country has a designated country chief who is responsible for coordinating engineer assistance in support of both short- and long-range country plans, goals and objectives. This individual develops and maintains an overall knowledge and institutional memory concerning the assigned country, is an active participant in engineer-related planning activities, and directs the activities of that country's deployment teams. To assist in the coordination of country team visits, the 412th established a forward element that is composed of two field-grade engineer officers and one senior operations/administrative noncommissioned officer.

Country deployment teams from the 412th normally consist of two or three officers and one NCO. To the maximum extent possible, each team is tailored to meet deployment mission needs. At least one, and preferably two, of the team members are graduate engineers. The deployment team chief is a graduate engineer (lieutenant colonel or major). Country deployment teams are generally supported during country visits by one administrative support individual who remains at SOUTHCOM Engineer's (SCEN) office in Panama. This soldier assists in trip report preparation, project file maintenance, and related duties.

In addition to 412th personnel, the teams include members from the Air Force and Mobile District, Corps of Engineers. While in country the teams conduct site inspections and prepare work estimates for potential nation assistance and counterdrug projects. These estimates include projections of manpower, material, and equipment requirements, and the timeframe in which the projects could be constructed. The projects are then evaluated in terms of their potential as sites for the deployment of engineer troops for training.

Since initial deployments in 1990, engineer teams have deployed to Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Guyana, Panama, Peru, Uruguay, and Venezuela. In Bolivia and Peru, engineer teams evaluated airfields, road construction, and water supply/sanitation projects.

Road construction projects and a ferry dock terminal project were evaluated in Costa Rica. In Ecuador, river port facilities, potable water supply projects, sewer sanitation projects, road and bridge projects, and airfield projects were assessed. In Guatemala, a site for a military base headquarters, extension and/or repair of existing airport runways, repair of a quaywall (seawall), a water quality improvement project, water well drilling projects, and a road construction project were investigated. The team deployed to Panama furnished support to

SOUTHCOM by conducting route reconnaissance and bridge classification for 11 road construction projects.

In Uruguay the team evaluated potential sites for water supply and well-drilling operations. The Venezuela team did not visit any sites but did consult with Venezuelan military officials to identify numerous potential projects, including solar energy projects, water supply, and sanitation. These projects would alleviate health hazards and foster economic growth by expanding the country's infrastructures and providing access to underdeveloped areas. Some projects would also provide facilities to aid in combating narcotics trafficking.

Project Summary

An engineer work estimate (project summary) provides a description of the project, scope of work required, the general priority of the project both from the host nation's and the country team's perspective, how the project relates to the ambassador's goals, and general specifications for construction. The summary will also specify material, manpower, equipment, and construction time requirements for specific project assessments for short-term tasking, and execution by U.S. military units and/or host nation forces. The project summaries may also serve as precursors to final design/construction documents or as the basis for more detailed project planning. The project summary includes a recommendation as to whether troop or contract effort should be used. A typical engineer work estimate (project summary) is shown below:

Cano Blanco Road (Costa Rica)
Project Summary

1. Project Statement.

a. Location. The project, which includes the improvement and construction of a road between Maryland and Parismina, is located in the Limon Province. Equipment could be shipped via sea ransport to the Port of Limon. The equipment would then be hauled or conveyed along Highway 2 to Siquirres. At Siquirres, the convoy would ake a gravel road to the site. This road is capable f supporting the maximum loads presented by the quipment. It should be noted that Del Monte has large banana plantation located near the project, nd uses the same route for large tractor-trailer nits loaded with bananas.

b. Scope of Work.

(1) The gravel road from Siquirres to Maryland as been improved to the point that it can support elatively large loads (approximately 84,000 pounds). The road has a wearing surface and is approximately 16 feet wide and capable of passing two large trucks. The road from Maryland to Cano Blanco is basically 7 kilometers (km) long and has a base 12 feet wide with no wearing surface. It is impossible to maintain. The project in this area requires adding a wearing surface and widening the road to 16 feet. The construction of 5 km of road from Cano Blanco to Parismina will entail clearing and constructing the roadway. This part of the project will need filter fabric placed prior to fill material.

(2) The road is important to the country because it opens a route to the Atlantic Ocean. According to Mr. Jose Chacundo, Assistant Director of the Ministry of Public Works and Transportation, construction of the road would:

(a) Facilitate the construction of a small port on the Rio Parismina. This would provide a much closer and cost effective route for the shipment of agricultural products.

(b) Provide access to families living in the region. During the site visit, it was noted that many families live in the area, especially along the Rio Parismina. Mr. Chacundo stated that these people have to rely on horses and canoes for transportation.

(c) Open access to the town of Parismina. The town of Parismina is a tourist community, catering to tarpon and snook fishermen. The only access to the town is water taxi or small airplane.

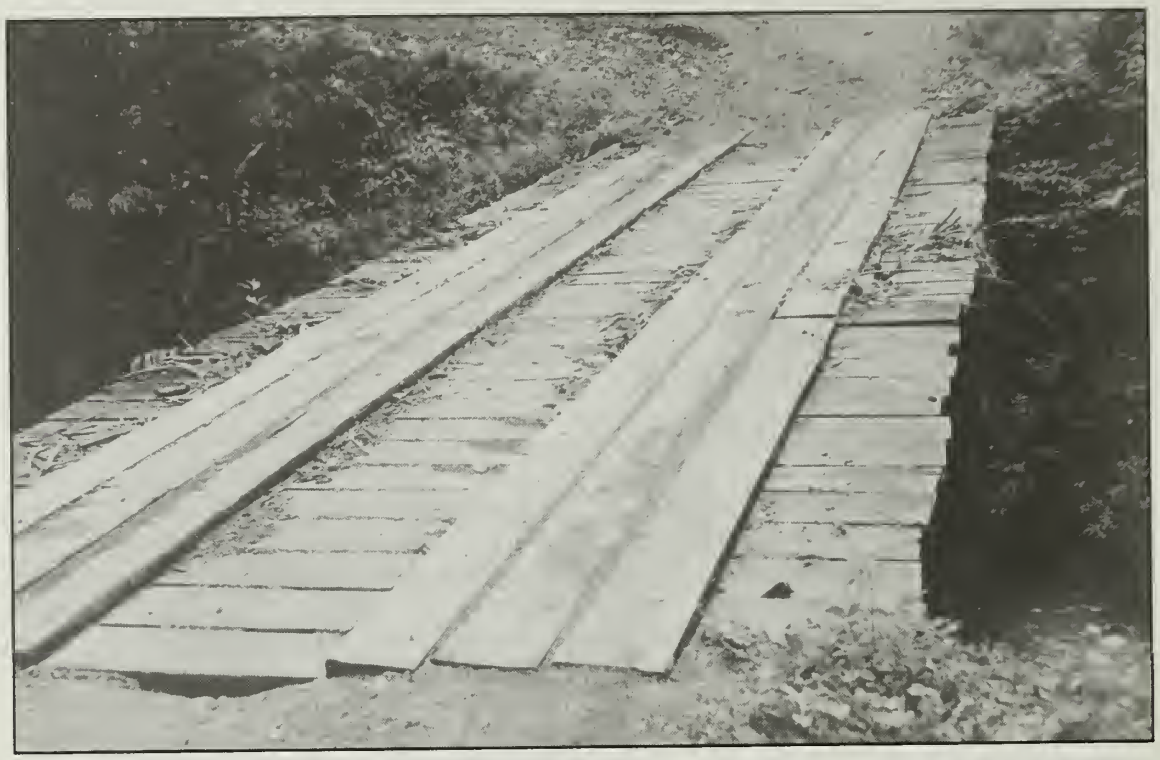
(3) Mr. Chacundo stated that this road project is the number one priority for his country. It was determined that the local citizens desperately want this project. Several local residents met with the country team, expressed their desire for the project, and stayed with the team during the site investigation. The local people provided canoes, horses, and a power boat to visit the site.

c. Background. The project supports the ambassador's goal of strengthening people-to-people relations by providing economic development and modernization. The strategic objective of democratization and economic modernization would be supported, and the country would be favorably disposed to U.S. interests. These projects are supported by the local people and will modernize the infrastructure in the region as well as promote economic development.

2. Terrain and Weather.

a. Site Characteristics.

(1) Geotechnical. The area soils generally consist of clayey silts to sandy silts. The top 6 to 8 inches have a high organic content. It was noted during the investigation that, during the wet season, the top organic layer gets extremely muddy



View of a road in Costa Rica where engineer work estimates were performed.

making transportation very difficult. The soil approximately 8 inches below the surface is usually not permeated by the moisture and is capable of supporting light loads. Mr. Chacundo stated that in the dry season this silt drys out and will support extremely large loads.

(2) Topographical. The project is located on the coastal plain. Only minor variations in elevation are evident. The project will cross one manmade canal.

b. Weather.

(1) Temperature Variations. The Caribbean region of Costa Rica is characterized by moderately high temperatures that vary only slightly throughout the year. Daytime temperatures range from 81 to 88 degrees Fahrenheit.

(2) Expected Rainfall. The mountain ranges that bisect the country block the rain-bearing northeast trade winds, causing heavy and continual rainfall in the Caribbean coastal area during the rainy season. Annual precipitation ranges from 35 to 60 inches. The wet season occurs from May through October and the dry season from January through April.

[illegible] The project should be constructed in at least two phases. The first phase will be the improvement of 7 km of road between Maryland and Cano Blanco. The only borrow pit for this project is a river site located approximately 15 km from the beginning of the project. The first phase should be completed before the second phase is started because the road probably would not support the continual hauling of fill material and aggregate and would not allow the passage of two dump trucks (the road is approximately 12 feet wide). To adequately improve the roadway in phase one, 12 inches of loose aggregate (9 inches compacted) should be applied, and the roadway increased to 16 feet in width. When the roadway is expanded, the new base should be compacted with a pneumatic tire roller to 95 percent standard proc tor. The aggregate for the wearing surface should be applied in 6-inch lifts and compacted with four passes of a vibratory roller. Once the aggregate surfacing is completed, the roadway should be final graded, and compacted with four passes of the pneumatic tire roller. The borrow area material is large river-run rock and will need to be crushed. The rock-crusher should probably be onsite at least one month prior to the heavy equipment.

The second phase of the project will involve the construction of a road between Cano Blanco and Parismina. The project will require the clearing of small vegetation (vines and grass) and large trees. The roadway will be constructed over several swam py areas ranging in size from 50 to 200 meters (m). Filter fabric should be used in these areas. A borrow pit about 5 km from Maryland will produce sand fill needed to construct the base. Approximately 24 inches of this fill will be required to raise the road above the natural ground. The sand fill should also be placed in 6-inch lifts and compacted with four passes of the vibratory roller. After four lifts have been placed, aggregate surfacing can commence. A crushed stone wearing surface of 15 inches loose (12 inches compacted) should then be applied, as described above.

4. *Materials.*

a. General Bill of Materials.

(1) First Phase. 13,000 cubic yards (cy) of aggregate will be needed to complete this phase. It is assumed that an additional 8,000 cy of material will be needed to maintain the haul road, for a total of 21,000 cy. The aggregate should have a gradation of:

Total Percent by Weight, Passing Sieves

2"	1-1/2"	3/4"	No. 4	No. 16	No. 100
100%	95-100%	65-95%	35-95%	35-55%	4-15%

A 10-foot section of 60-inch corrugated metal culvert is also needed to extend one culvert.

(2) Second Phase. 18,500 cy of fill material will be needed to construct the road base, and a total of 11,500 cy will be needed for the wearing surface. Approximately 11,500 cy of aggregate will also be needed to maintain the haul road, since hauling will be over the road constructed on the new base and some settling is anticipated. Total aggregate required is 23,000 cy, with the same gradation as in the first phase. A 40-meter bridge designed and acquired by the Costa Rican Government should be on-site. Approximately 1,500 m of filter fabric, 24 feet wide, will be needed for construction through the swamps.

b. Source. All aggregate will come from a river borrow pit approximately 15 km from the start of the project. A small sand hill approximately 5 km from Maryland will provide all earth fill for the project. The culvert, bridge, and filter fabric will be provided by the Costa Rican government.

5. *Equipment.*

a. Military Inventory.

(1) First Phase.

Type	Amount	Time Estimate (Days)
Rock-crusher	1	90
Front-end loader (5 cy)	3	60
D7E dozer	2	75
Motor grader	3	75
Tractor trailer	4	90
5-ton wrecker	1	90
Contact truck	1	90
Pneumatic tire roller	1	75
Vibratory roller	1	60
5-ton dump trucks	20	60

(2) Second Phase.

Type	Amount	Time Estimate (Days)
Rock-crusher	1	145
5-ton dump truck	20	120
Front-end loader (5 cy)	3	120
D7E dozer	4	145
Motor graders	4	145
RTO crane (20-ton)	1	30
Tractor trailers	5	160
5-ton wrecker	1	145
Contact truck	1	145
Concrete mixer	1	30
Pneumatic trailer and tools	1	30
Vibratory roller	1	145
Pneumatic tire roller	1	145

(Note: Twenty dump trucks are projected and it is anticipated that at least 15 will be operational at all times. The time estimate is based on using 15 trucks.)

b. Nonmilitary Inventory. None.

c. Fuel and Repair Parts. Fuel can be obtained in Siquirres. Repair parts can be air delivered to San Jose and then delivered via truck to the project site.

6. *Manpower.*

a. Detailed Site Exploration/Project Design. No further site exploration is needed. The project design detailed in this report is sufficient to construct the project.

b. Types of Construction Skills. The project can be constructed by either a combat construction or combat construction heavy unit. The construction unit should be company size, augmented with additional heavy equipment operators from the battalion. The construction can be performed by Active, Guard or Reserve units on 2- or 3-week rotations (preferably 3 week). Total time required from deployment through redeployment is 90 days for phase 1, and 145 days for phase 2. Key officers and noncommissioned officers should overlap rotations by at least 3 days for continuity of operations.

c. Types of Support Skills. The construction troops should be augmented by organic maintenance and mess personnel. The company should have personnel with local purchase order authority, and the battalion's maintenance section should be added. A Costa Rican security force should be assigned for base security operations. A water purification team with a reverse osmosis water purification unit must be on-site to provide potable water.

7. *Time.*

a. Project Design. No further project design is required for the first phase. The second phase will require that the Costa Rican government design a bridge to span the man-made canal.

b. Material Acquisition. The rock-crusher should operate from December through April so that adequate supplies of rock are available. The rock crusher should be on-site approximately one month prior to the arrival of construction troops in order to have a stockpile of aggregate at the start of construction. The crusher should operate continually through construction so that a stockpile of material can be left for the local maintenance crews. The Costa Rican government will need sufficient time to design and procure a bridge.

c. Equipment Acquisition. Equipment can be shipped via sea to the Port of Limon and then transported overland to the project site.

d. Support Facilities Construction. A basecamp should be constructed by the battalion's vertical section, with construction taking approximately seven days.

8. Summary conclusions.

a. The first phase of the project lends itself to troop construction. Equipment can be easily transported to the project. The project is not complicated and could be constructed by almost any engineer unit.

b. The second phase of the project lends itself to troop construction; however, this phase of the project should be ended at the man-made canal. As stated in the time estimate, this entire phase should take approximately 145 days to complete. By stopping the phase at the canal, the time estimate is decreased to approximately 80 days.

Other 412th Projects

Members of the 412th are also preparing engineer annexes in support of the ambassadors' country plans. The annexes are definitions and forecasts of long-term nation development needs, primarily from the host nations' perspective. Developed by in-country visitations with host nation officials and ministries, the engineer annexes serve as the basis for identifying specific construction projects to support host nation/U.S. goals.

Similar to the Civil Engineering Support Plans generated for the European theater, Engineer Construction Management Plans (ECMP) are being developed. These plans are summaries of engineer requirements specific to a host nation and/or a SOUTHCOM campaign area. The 412th is compiling a theater-specific computerized construction management data base for forecasting, prioritizing, controlling, and supporting the execution of identified construction requirements. The command will also recommend an engineer force structure capable of accomplishing the construction requirements of SOUTHCOM's campaign plans.

Engineer force requirements will be driven by engineer construction management plans and will involve determinations of the engineer units/resource needs for design and construction accomplishment. All facets of the engineer work force will be addressed, including U.S. military and civilian capabilities, and host nation capabilities. Recommendations will be made as to the most appropriate means to construct specific projects. Close coordination will be maintained in this effort with the SCEN, Forces Command, the host nation, and the Mobile District, Corps of Engineers. An engineer support matrix is being developed which will identify overall engineer responsibilities for coordination, planning, design, and construction of projects in the SOUTHCOM area of operations.

During Fiscal Year 92, at least 19 engineer teams from the 412th Engineer Command visited 11 countries in Central and South America to support the SOUTHCOM mission. The emphasis of these deployments is to train 412th personnel while assisting these nations in formulating viable procedures to develop their infrastructures. The 412th exchanged information with the host nation engineers and develop methods of training them, or keeping them abreast, of state-of-the-art construction techniques.

To strengthen future deployments, home station training is currently being conducted in numerous areas, including:

Spanish language
vertical construction
road design/construction
bridge construction/placement
environmental designs
terrain/trafficability analyses
capability of engineer units
soil classification
hydraulics and hydrology
airfield design/ rehabilitation
sanitation (pumping systems)
oil stabilization methods
road and bridge classification
metric system of measurement

"The work we're doing in SOUTHCOM is very important," remarked Major General Hale. "Not only does it provide valuable training for our unit members, but it helps the less developed Latin American countries and gives them a positive image of the United States."

Major Bottin is a Reservist and public affairs officer for the 412th Engineer Command. Previous assignments include headquarters commandant, liaison officer, facility engineer, executive officer, and civil engineer. As a civilian, he works as a physical scientist at the U.S. Army Engineer Waterways Experiment Station. He recieved his bachelor's degree from the University of Southern Mississippi, and is a graduate of Command and General Staff College.

Major Fowler is a Reservist and facility engineer with the 214th. Previous assignments include headquarters commandant and refrigeration / air conditioning engineer. In his civilian occupation, he serves as a hydraulics engineer for the U.S. Army Engineer Waterways Experiment Station. He earned his doctriate degree from Clemson University, and is a graduate of Command and General Staff College..

The Engineer Challenge

By Dr. Robert Sickler

During Desert Shield, the tragedy of past U.S. Army apathy toward the need for a dynamic and effective countermine capability came to light. Not only the military, but politicians and the public became aware of the broken U.S. Army countermine program. Illumination of the countermine problem has opened a door of opportunity through which Army engineers can gain support and research dollars for countermine systems development.

Unfortunately, Desert Storm's rapid victory and the new TRADOC Battlefield Dynamic Institutes (Battle Labs) threaten to close this door. I contend that engineers must keep the Army focused on countermine issues long enough for us to establish a technology breastwork for future systems development. Fate has thrown a gauntlet before the engineers, and we must rise to the challenge!

As preparations were being made to assault Iraqi defenses in southern Kuwait, it became apparent that our countermine assets for this task were woefully lacking. Since the 1950s the Army's countermine development effort has focused on defeating a Soviet mine warfare capability. In our quest for a countermine silver bullet we filled a graveyard with dead and unfielded countermine systems (SLUFAE, VEMASID, MIRADOR, MASSIS, VMDS, ROBAT, COV, LIBS, AN/PSS-7&8). Thus, not only did we have nothing new to take to Kuwait, our most sophisticated countermine ystem (the Mine Clearing Line Charge (MICLIC)) often failed to perform its mission.

Desert Storm made it clear that our current countermine technology is inadequate. Inadequate because today, as in the past, TRADOC has been unable to focus basic research toward countermine and other engineer needs. Without basic research to bring forth new technologies, old technologies are reworked and reworked, and countermine systems remain inadequate.

Mine-Countermine History

The need for land mines began in the September 1916 Somme battle, when allied forces demonstrated that tanks, if properly employed, were a major contributor to mobility. As tanks began to influence the outcome of battles, armies were forced to develop ways of defeating this new weapon. In the German trenches of World War I, for example, soldiers fabricated "traps" (land mines made from artillery shells or boxes of explosives) which were designed to detonate under tanks. Although the use of land mines began in World War I, countermine development did not begin until World War II.

During the Second World War, British troops in North Africa were faced with tremendous losses due to land mines. To counter this threat the British began an extensive developmental program to build countermine systems. By the time of the Normandy invasion they had built rollers, plows, flails, explosive line charges, and both hand-held and vehicle-mounted mine detectors.

The American Army unfortunately did not agree with the British on the need for countermine systems. This attitude changed quickly when, as a result of very limited breaching assets, the American landings at Omaha Beach were a disaster. Forced by necessity, we then began making "Yankee" modifications to British countermine systems, and had developed a very expanded countermine inventory by the end of the war.

Gulf War Experience

Wrapped in the banner of World War II success and with a belly full of new countermine tools, the U.S. Army entered a state of countermine comatose. It was a coma so deep and widespread among the branches that, to this very day, the U.S. Army has not fielded a single new countermine system. This was proven in the Gulf War: The allied countermine devices in Kuwait were rollers, plows, flails, explosive line charges, rakes, and hand-held mine detectors. Although modified by many years of repetitious programs that reworked past technology, they were the same basic systems developed in World War II.

Luckily for many American fighting men, our antique countermine systems were never really put to the test! The anticipated level of Iraqi resistance never materialized, and the war ended without any significant ground

(Continued on page 51)

Water Distribution in a Bare-Bones Base Camp

By Major Michael W. Biering

Providing a reliable supply of potable water for a base camp located in a remote area of north-central Honduras sounds simple enough. But making it happen took a lot of brain and brawn on the part of Task Force 536, which deployed to Honduras in January 1992 as part of the Fuertes Caminos exercises.

The 550-man task force consisted of the 536th Engineer Battalion (Combat) (Heavy) from Fort Kobbe, Panama; elements of the 41st Area Support Group, 193rd Support Battalion, and the 142nd Medical Battalion; the 534th Military Police Company; Team Delta, 535th Engineer Detachment (Prime Power); and the 162nd Combat Communications Group, California Air National Guard.

Planning for water supply and distribution for TF 536 started with a site survey of the proposed base camp area. The camp would be located in a 75-acre cow pasture in the Aguan River valley. The Macora River (actually a small stream) originates in the surrounding mountains and ran along the southeastern edge of the base camp. Unfortunately, the area had no significant terrain relief suitable for elevated water storage.

The task force S-3 used the site survey to begin work on the water system, and considered several factors in the design:

- The Macora River was unsuitable for use as a sustained, principal water supply. Upstream of the base camp, the local population used the river for bathing and washing clothes, and livestock entered the stream at will. That meant a well would be required.
- Because of the lack of terrain relief, the camp needed a storage tower to provide pressure to the water distribution system.
- Water purification assets were needed to meet water quality standards.

The task force then determined the amount of water needed to sustain the camp. We set the authorized population for the base camp at 550 personnel. System designers calculated total daily demand (TDD) for personnel, shower and laundry operations, and the following consumption rates:

Consumer	Gallons/Day/ Soldier	Remarks
Personnel	7.5	Includes 50 percent increase for hot climates
Laundry	5.0	Based on two loads/soldier/ week, 17.5 gal per load
Bathing	35.0	Based on two showers/ soldier/day at 17.5 gal per shower
TOTAL	47.5	

This consumption formula yielded a TDD of 26,125 gallons per day. Therefore, the camp required a storage capacity of half this amount, or 13,063 gallons.

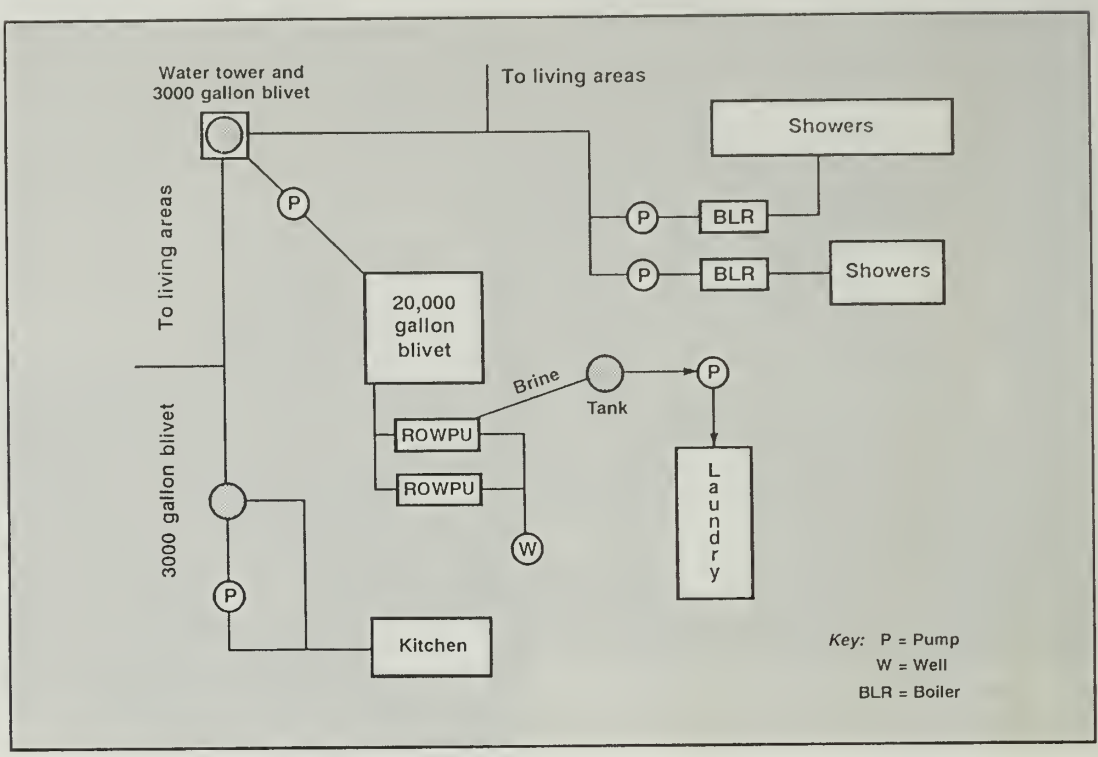
The task force TDD clearly exceeded the theater of operations (T/O) guidelines of 5 to 25 gallons per person per day. Those guidelines include two showers a week for each soldier. However, the task force commander decided that this was inadequate to meet the rigorous schedule of daily physical fitness training and road construction for the six-month deployment.

The S-3 shop did not consider facilities demand in the design because there were no hospitals, bakeries, or other large water consumers planned for the site. The commander also decided that the base camp, a temporary facility, did not require water for fire protection.

Designers calculated peak demand based on the camp's shower facilities. Using 36 shower heads with a fixture value of 4.0, and 20 sinks with a fixture value of 2.0, designers calculated a peak demand of 61.8 gallons per minute.

Above: The completed water tower provided pressure for the water system.

Below: The 20,000 gallon water storage bag and one of two ROWPUs. Well head is at the right of the round 3,000 gallon water storage bag.



Water Distribution Schematic

Assets to put the system together were the next priority. Two 600-gallons per hour, reverse-osmosis water purification units (ROWPU), a portable bath unit, and a 20,000 gallon water storage bag were obtained for the site. Some general plumbing materials were obtained from Honduran contractors.

The needed well was drilled by an Air Force Red Horse (engineer) unit. The unit drilled a 6-inch, 117-foot, gravel-packed well, and installed a multi-stage, 5-horsepower Zoeller Model 70L pump at 55 feet. The static water table was at 15.5 feet.

To determine well capacity, the S-3 section established a maximum allowable drawdown of 45 feet below ground level. This allowed an acceptable safety factor to prevent pump damage in the event of over-pumping the well. A drawdown test was conducted at a constant pumping rate of 55 gallons per minute. Well drawdown reached the 45 foot level after 12 hours of constant pumping.

The well recharged to the original static water level in four hours. Using the established pumping rate, we calculated the well would produce 39,600 gallons of raw water for the ROWPUs every 12 hours. About 60 percent of this water, or 23,760 gallons, would be processed as potable by the ROWPU. This would meet the camp's requirements.

Having taken care of the well, demand calculations, and initial assets, we turned to the supply and distribution system.

Water tower height would be limited to 20 feet because of the limited length of poles available in Honduras. Shower and laundry facilities, the largest water users, would be located at the base of the tower to minimize pressure loss in the supply lines to these facilities.

Before entering the distribution system, processed water was stored in the 20,000-gallon storage bag. Storage time was limited to 24 hours to eliminate the risk of contamination. The water was then pumped to a 3,000-gallon storage bag at the top of the water tower. We did this with a diesel-powered 170-gallon per minute, 21.5 pounds per square inch (psi) centrifugal pump. We could fill the tower bag in less than 20 minutes, allowing for uninterrupted base camp service.

Discounting line losses, and using a 3,000-gallon bag for water storage at the top of the tower, we could only expect about 10 psi water pressure at the tower's base. This was below the T/O standard of 20 psi needed to run base camp facilities. While it was suitable for hand washing facilities in selected areas of the base camp, it was not adequate for the showers, laundry, or kitchen.

We solved the water pressure problem as shown in the schematic above. Since raw water was provided under pressure to the ROWPUs from the well pump, several extra pumps were available from the ROWPU set.

For the showers, we placed 2-horsepower electric centrifugal pumps in the supply line before the bath unit boilers. The pressure relief valves on the boilers protected the system, and with some maintenance and fine-tuning, the showers worked fine.

We used the same arrangement for the camp laundry. An electric pump from the ROWPU set provided the necessary pressure for 10 commercial washing machines. As a side note, we pumped laundry water from the ROWPU brine tank. This tank contained treated—but not chlorinated—water. This procedure saved us from wearing progressively bleached BDUs during the six-month deployment.

The kitchen pressure problem was solved by increasing the line size to reduce pressure loss, and gravity feeding the water into an additional storage bag next to the kitchen. We used another electric pump from the ROWPU to pressurize the kitchen system. No pressure relief valve was available to install in the system, so we looped the supply line in front of the pump back into the water bag. This prevented broken pipes and pump damage if all water outlets in the kitchen were closed at the same time.

Each of the branches of the "dead-end" distribution system was isolated by a gate valve to facilitate system maintenance and repairs. All water lines were buried for protection.

The task force learned many valuable lessons about base camp water supply in a relatively barren location. The first lesson was the importance of information provided in Engineer School materials, and Army field and technical manuals. Most of what we accomplished was based on information in these publications.

Secondly, Army engineers must be innovative in their approach to problems—and not limit themselves to "textbook" solutions. The way the task force handled the low pressure problem is a good example of this.

Next, we learned that standard PVC (polyvinyl chloride) pipe does not hold up well under pressurized hot water. Within the first 30 days of the exercise, the hot water supply line to the showers had to be replaced with galvanized steel pipe. No CPVC (chlorinated PVC) was available from Honduran contractors.

Water supply to the base camp was a challenge, but one that the engineers were able to meet. Their work, along with that of the other soldiers and airmen, turned a Honduran cow pasture into "home" for the six months of Fuertes Caminos 1992.

Major Biering is S-3 of the 536th Engineer Battalion. Previous assignments include engineer exchange officer to Brazil, assistant district engineer, Savannah District, Corps of Engineers, and company commander for the 3rd Engineer Battalion (Combat). He is a graduate of West Point, Command and General Staff College, and Georgia Tech University, where he holds a master's degree in soil mechanics. He is a Registered Professional Engineer in Virginia.

The ENGINEER Writer's Guide

We think engineers take a special pride in their profession, and *ENGINEER* is always looking for articles from readers who want to share their expertise, experience and ideas.

If you're a potential contributing writer, here are a few "writer's guide" tips that should help steer you in the right direction:

Articles can cover engineer training, operations or doctrine, engineer equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers—that's what we need.

Articles should generally come from contributors with first-hand experience with the subject being presented.

Avoid theatrical writing styles like: "It was a dark and stormy night...," or "...the soldier blazed through the jungle on his lumbering D7, providing a trail of freedom for the other vehicles...."

Articles should be concise, straightforward, and in the active voice.

Length should range between 2,000 and 4,000 words, and the text should be typewritten and double-spaced. Generally, each such page will contain from 200 to 250 words.

Articles containing attributable information or quotations not references within the story should carry appropriate footnotes.

Manuscripts must be original, unpublished, and not under consideration by another publication. Normally, you can expect a reply to your submission within one month after we receive it.

All submissions are subject to editing.

Contributors are encouraged to include black-and-white photos, artwork, and/or line diagrams to help illustrate your article.

Include your full name, rank, current unit and job title. Also include a list of your past assignments, experience and education, your mailing address, and commercial daytime phone number. Send your articles to: Editor, *ENGINEER* Professional Bulletin, ATTN: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650.

If you have questions about an article you're working on—or considering writing—give our editor, Cathy Eubanks, a call at DSN 676-7535, or commercial (314) 563-7535.

We look forward to hearing from you.

Living with Foreign Commercial Construction Equipment

By Captain William J. Penny and Captain Paul D. Cramer

Important lessons were learned during the Gulf War concerning the military use of foreign commercial construction equipment for pre- and post-war missions. With more emphasis on containing costs for military operations abroad, "falling in" on such equipment is becoming a more attractive proposition for the Army.

But while cost-effective, the use of foreign commercial equipment has drawbacks, and commanders must consider several potential obstacles to mission accomplishment. These include maintaining the equipment without an associated maintenance support system, and giving equipment operators adequate training.

The 34th Engineer Battalion (Combat) (Heavy) deployed two companies to the Gulf to assist in theater closure operations. While taking along much of their gear, the units did not deploy with their organic construction equipment. Instead, Government of Japan (GOJ) commercial equipment was provided when they arrived in the Gulf. The units gained valuable experience in the use and maintenance of foreign commercial equipment. This article shares some of that experience with engineers who may find themselves in a similar situation.

Two significant problems surfaced as soon as the equipment was placed in operation: lack of manuals and difficulty procuring of repair parts.

Some of the Government of Japan purchased trucks used by the 34th Engineers included Nissan 20-ton dump, Hi-No fuel, and Mack trucks.

Kamotsu and Champion road graders were used by the engineers in lieu of TOE equipment.

Manuals

The GOJ vehicles did not have comprehensive operator or maintenance manuals. The lack of manuals outlining procedures for preventive maintenance, checks and services (PMCS), scheduled services, and repair was a major hurdle. The entire Army maintenance program is based on checks before, during and after vehicle operation. Without proper references to guide operators and mechanics, maintenance can become a haphazard affair.

The companies adapted organic equipment maintenance procedures for the commercial equipment. Although the mechanical components were different, there were enough similarities to maintain a relatively effective fleet of vehicles. Maintenance of unfamiliar components was left to careful trial and error.

Commanders of units deploying to regions where commercial equipment may be used should determine the kind of equipment on station. If manuals are not with the vehicles, obtain them from the distributor, manufacturer, or other source. The effort will be well worth it. Considerable savings in maintenance down time and operator training can be realized if the proper manuals are on hand.

Repair Parts

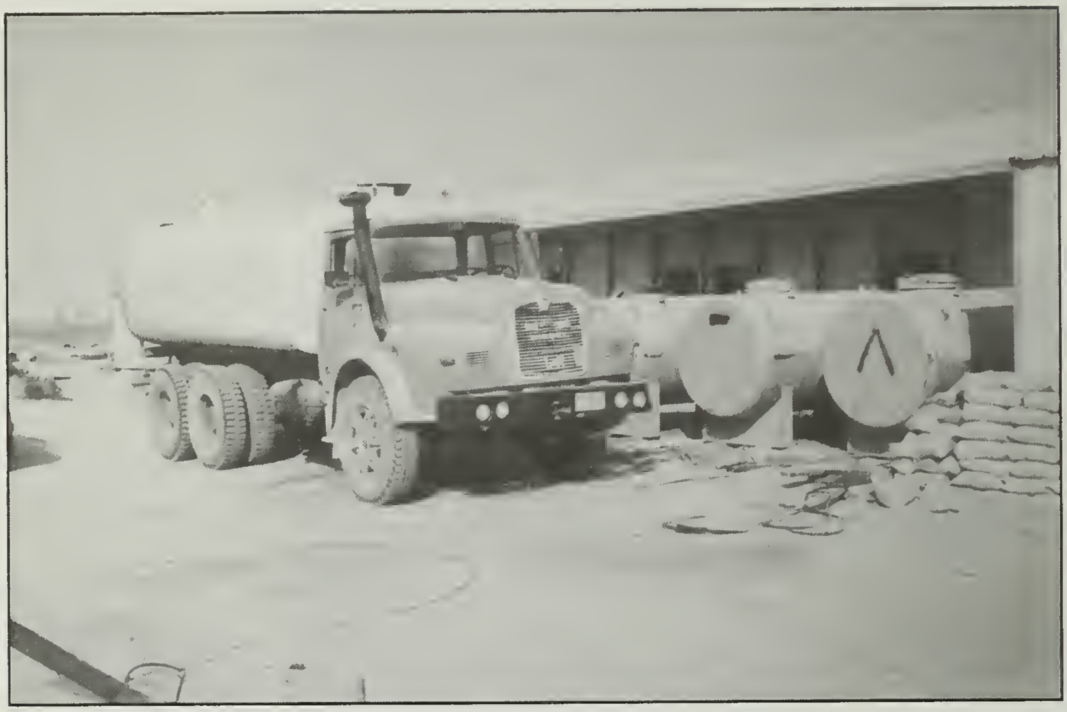
Another negative spin-off of the lack of manuals surfaced with repair parts. Replacing worn or inoperable parts was a tedious, hit-and-miss proposition. Without parts numbers or illustrations for reference, parts had to be removed and taken to vendors to try for a match. This was a time-consuming operation because of travel time to the vendor and time spent trying to match components with illustrations and stock numbers.

One bright spot in the repair parts area was the use of a blanket purchase agreement (BPA) by the two engineer companies. The BPA made the job of paying for parts easier and reduced lost time.

Operator Training

Fortunately, getting soldiers up to speed on the foreign equipment was not as challenging as equipment maintenance. But the variety of equipment, coupled with the lack of operator manuals, required close attention to training.

The foreign equipment used by the 34th units included Kamotsu and Champion road graders, Nissan 20-ton dump trucks, Hi-No fuel trucks, D9 dozers, and Mack trucks. Each of these equipment manufacturers has a different philosophy about the arrangement and functioning of controls and instruments, much like the differences between major makes of automobiles. For example, the control lever for the blade of a Caterpillar road grader might have the same appearance and be in the same location as the throttle lever on a Kamotsu road grader.



While the equipment held up well under heavy use, maintenance was a challenge because of the lack of manuals.

To compensate for the differences between TOE and foreign equipment, the 34th developed a training program for operators that included:

- Equipment familiarization
- Equipment operation
- Preventive maintenance checks and services

Familiarization called for operators to sit in the driver's seat of each vehicle and work the controls. By practicing with static equipment, soldiers became thoroughly familiar with the location and function of all controls.

During the second phase of training, soldiers operated the equipment in a designated practice area. This allowed the operators to get a feel for the sensitivity of the hydraulics of each piece of equipment. Solid proficiency on TOE equipment made it relatively easy for the operators to transition to the foreign equipment.

After becoming familiar with the equipment, operators were given instruction in proper preventive maintenance procedures.

Cross-Training

Some forethought on the part of the battalion's leadership paid off after the companies deployed to the Gulf. Prior to leaving, operators had been cross-trained on different pieces of TOE equipment. This allowed commanders greater flexibility in assigning missions. For example, with cross-trained operators, commanders could assign missions based on the total number of assigned operators instead of limiting specific missions to individual operator MOSs such as 62J, 62E or 62F.

A More Frequent Option

Military-leased foreign commercial equipment is now being used by engineer units in Honduras, Bolivia, and elsewhere. And the use of foreign equipment appears to be an increasingly viable method of augmenting TOE equipment in some circumstances.

By planning ahead, engineers can make maximum use of this relatively new resource. Prior to unit deployment, the advance party should determine the makes and models of all equipment and ensure all manuals are on site. If not, get them from the manufacturer or a distributor. Cross-train operators on TOE equipment. This will make familiarization with foreign commercial equipment easier, and will expand mission capabilities.

While certainly not a replacement for equipment built to military standards, commercial equipment can be an important asset in non-combat areas. The important role of foreign construction equipment was proven in the Gulf War.

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Captain Cramer is commander of Bravo Company, 34th Engineer Battalion. He previously served in the 317th Engineer Battalion. He is a graduate of the Engineer Officers Advanced Course, and is a registered professional engineer in Virginia.

Book Review

The Coming War With Japan, by George Friedman and Meredith LeBard, St. Martin's Press, New York, 1991, ISBN: 0-312-05836-5, 403 pages.

The title warns of imminent war in the Pacific—war in our time. Round Two, as it were, of the Pacific Theater in World War II. The major premise is that the fundamental conditions for which Japan challenged the United States for hegemony of the Pacific in 1941 are re-emerging in the post-Cold War era. The enemies of World War II, who later became friends, are now becoming enemies again.

"No greater power can tolerate a situation in which the very lifeblood of its society and economy are in the hands of another nation, let alone a nation that has interests fundamentally opposed to its own."

Since 1945, Japan has exercised sovereignty at the pleasure of the United States. We encouraged Japanese industry and gave her free access to American markets (the Korean War pumped billions of dollars into the Japanese economy). The U.S. used Japan as an instrument for "containment," the policy of opposing the spread of Soviet communism. American bases in Japan were crucial to containment because the Japanese archipelago "sealed" the Soviet Far East. Japan has successfully adjusted to less-than-full sovereignty by restructuring herself into a trade giant. Thus, the U.S. and Japan had different but converging interests—American containment and Japanese trade.

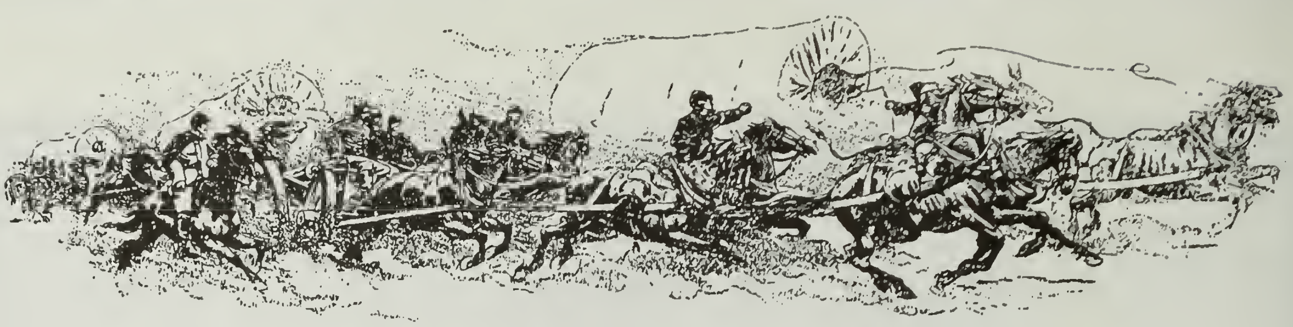
Japan's attack on the United States on 7 December 1941 was a desperate gamble to establish the "Greater East Asia Co-Prosperity Sphere." Japan had already reorganized Korea, Manchuria (Manchukuo), and key coastal parts of China into her economy. As rich as these prizes were, she still lacked the natural resources a modern nation needed to be a "going concern." Japan's northern strategy and victories on the Asian mainland encouraged her and aroused only indignation from western powers, but they did not provide the oil she needed. For oil Japan had to go south, and the U.S. Navy was in her way.

Japan thought she saw a window of opportunity caused by an inadequate American naval building program and our preoccupation with the war in Europe. Japan bet that she could extend the frontiers of the Greater East Asia Co-Prosperity Sphere so far into the Pacific and Indian Oceans that "pinpricks" at the edge would not affect the inner core. Japan gambled and lost everything, including her sovereignty.

Since 1945, the U.S. has returned elements of sovereignty to Japan. The most important element not returned is military power. The three elements of any nation's influence are political will, economic strength, and military capability. Japan has the first in abundance: she is highly organized and capable of decisive political action. Japan's economic strength is more apparent than real: a month or two of an effective oil embargo would sink her economy. Japan's current military force projection capability is totally inadequate to preclude depredations to her vital interests. Today, Japan is barely an Asian military power, much less a world power. She has little interest in reconstituting her military power—why should she? The U.S. Navy protects her sea lanes in a manner that was only a dream for the old Imperial Japanese Navy.

The authors convincingly describe Japan's rising desperation in the post-Cold War era.

(Continued on page 31)



The Battle of Chancellorsville

By First Lieutenant John A. Vigna

By April 1863, the American Civil War entered its third year. The divided nation was coping with two devastating years of a war which was originally predicted to last less than a month. Thus far, the Union failed to crush the rebellion and no end was in sight. The Union Army of the Potomac, under Major General Joseph Hooker, its fifth commander, attempted to bring a sweeping end to the war by defeating General Robert E. Lee's Army of Northern Virginia at the Battle of Chancellorsville.

The events that unfolded from April 28, 1863 to May 6, 1863, however, dashed all Union hopes of a quick ending to the war. Despite being greatly outnumbered, Lee decisively defeated Hooker at Chancellorsville using an aggressive offense, tactical surprise, and superior battlefield intelligence. By employing these principles, Lee caused Hooker to lose confidence, react defensively, and retreat in defeat. At Chancellorsville, Lee arguably fought his greatest battle against heavier odds than in any other campaign of the war.

Following the Union's disastrous defeat at Fredericksburg the previous December, Hooker's army occupied winter camps on the north side of the Rappahannock River. In the first two years of the war, the Union had no decisive victory over the Confederacy, and the Union soldiers' morale and confidence were very low. Thus, Hooker's tasks were to restore his army's morale, decisively engage and defeat Lee's army, and bring an end to the rebellion.

By early April, President Abraham Lincoln reviewed Hooker's rejuvenated army with great satisfaction. Hooker now possessed an impressive, well-equipped force of infantry and cavalry totaling 134,000 men and an artillery division of 404 cannon. "Fighting Joe," as Hooker was known, boasted that he had "the finest army on the planet," but Lincoln did not have nearly as much confidence in Hooker's competence to command the army as he did with the army's readiness.

Meanwhile, Lee's army, the antithesis of Hooker's, occupied positions in and around Fredericksburg. What his battle-hardened men lacked in numbers and supplies, they made up for in morale, experience, and confidence. The absence of over half of Lieutenant General James Longstreet's corps depleted Lee's forces after they were sent south to Suffolk to counter a supposed threat to Richmond. Therefore, at his immediate disposal, Lee had approximately 57,800 men and cavalry and 170 cannon.

With winter subsiding and the good weather upon them, both armies devised their plans. Hooker's plan was aggressive. He planned to dispatch Brigadier General George Stoneman's cavalry to disrupt Lee's rear and attempt to trap him in Fredericksburg. He then planned to cross his V, XI, and XII Corps over the Rapidan and Rappahannock Rivers, secure all ford sites, and assemble around the small, one-building village of Chancellorsville. Meanwhile, his I, II, III, and VI Corps would cross south of Fredericksburg, fix Lee if he stood fast, pursue him if he retreated to Richmond, or attack him if he withdrew towards Chancellorsville. In all, Hooker's plan of double envelopment via "dual pincers" was beautifully simple as all great plans must be.

Lee's plan was equally simple. He initially elected to remain in a tactical defense around Fredericksburg and let Hooker make the first moves.

This strategy proved effective and less costly than previous battles with the Union Army. Lee, while always offensive minded, decided to give Hooker until May 1, 1863 to make his move. If Hooker remained in the defense, Lee would attack Hooker to help relieve pressure on other Confederate forces in the west and south.

Hooker began his offensive on April 13, 1863. Thirty-six hours of rain, however, prevented Stoneman from crossing the Rappahannock until April 28. This delay disrupted Hooker's maneuver timetable. The ensuing battle would be over before Stoneman could reach Lee's rear and provide any battlefield intelligence to the Union Army. The delay also gave Lee ample time to react to Hooker's actions. Hooker, however, continued with his plan. On April 28, his I, III, and VI Corps conducted demonstrations south of Fredericksburg, while his main body crossed the Rappahannock. Two days later, Hooker's II, V, XI, and XII Corps assembled around Chancellorsville, outflanked Lee, and sat in his rear. Lee was skeptical of Hooker's maneuvers but did not fall for the demonstrations at Fredericksburg. He felt Hooker's intentions were elsewhere. Later that morning, General J. E. B. Stuart, Lee's cavalry commander, confirmed Lee's conclusion when he reported that the Union Army was assembling near Chancellorsville. Lee, aware of the threat to his rear, decided his only options were to attack or retreat. Believing Hooker wanted him to retreat and that a large engagement would take place in his rear, Lee dispatched Major General Lafayette McLaws' and Major General Richard Anderson's divisions, as well as Stuart's cavalry, toward Chancellorsville to intercept the Union advances.

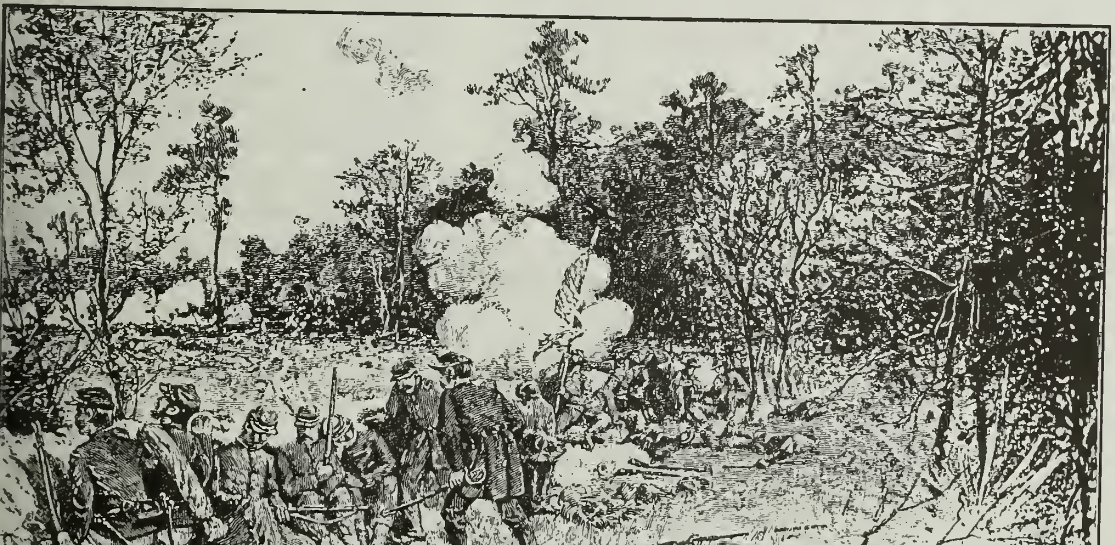
The stage was now set for the battle. The two armies made contact on May 1, 1863. For the better part of six days, they bitterly fought each other in restricted terrain, until Lee once again soundly defeated yet another Union commander. Over the course of those six days, four critical events led to Hooker's ultimate defeat. These events portray Lee's use of aggressive offense, tactical surprise, and superior battlefield intelligence.

The first critical event of the battle was Stoneman's failure to cross the Rappahannock River on April 13. This rain-delayed crossing disrupted Hooker's plan by two weeks and set the stage for the rest of the battle. Instead of waiting for Stoneman to conduct his missions, Hooker decided he had lost valuable time and must launch his offensive without the full benefit and use of his cavalry asset. This proved costly throughout the battle. Hooker's inactive cavalry provided him with absolutely no intelligence on Lee's forces. Hooker was also unable to disrupt Lee's maneuver intentions or keep the famed Confederate cavalry in check and diverted from the battle.

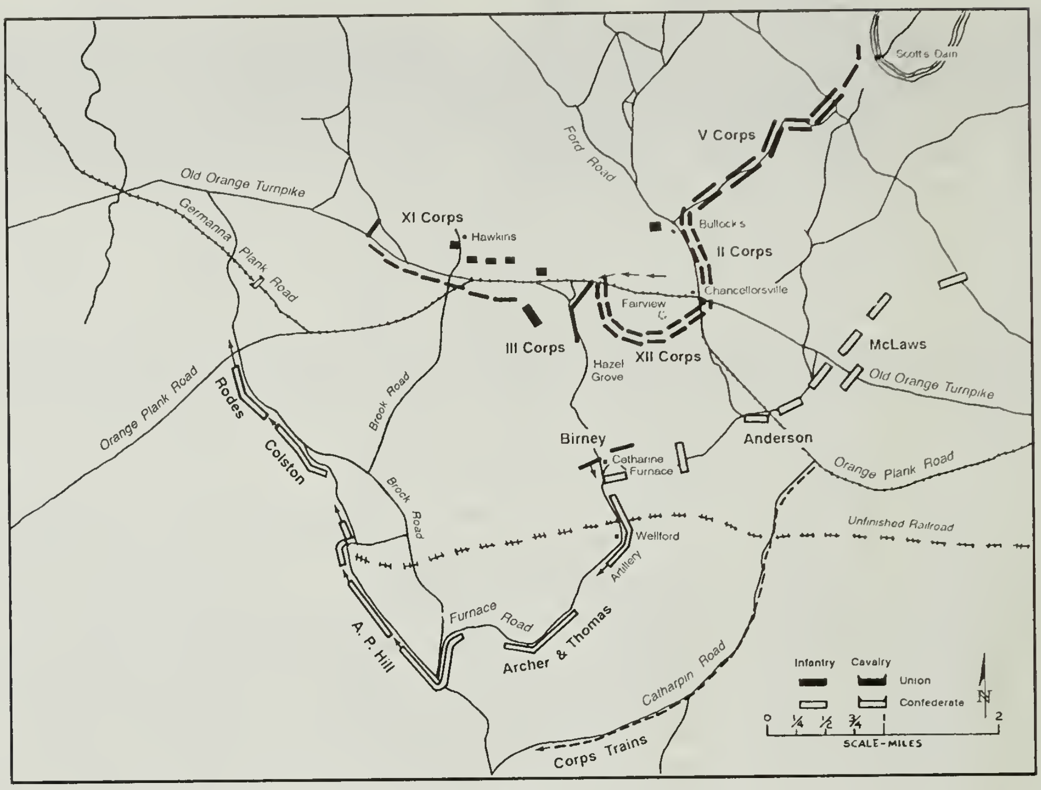
The second critical event was Hooker's delay in attacking Lee's advance elements of McLaws' and Anderson's divisions on May 1, 1863. On that morning, Hooker failed to advance his consolidated forces with any sense of urgency.

While Hooker waited around Chancellorsville, Lee's advance elements made contact with the Union Army. Hooker did not continue his maneuver plan because, with no hard intelligence, he was uncertain of the size of the enemy to his front. When Hooker finally gathered enough nerve to attack the Confederate forces, Lee had already arrived with his remaining men to unite his army and stifle any Union momentum. Lee's aggressive offensive action surprised Hooker and seemingly caused Hooker to lose his nerve.

Despite Hooker's vacillation, the Union held the strategic high ground of Hazel Grove and Fairview around Chancellorsville and was able to gain ground on the Confederates. By nightfall, however, Lee's outnumbered men put



The 29th Pennsylvania (of Kane's Brigade, Geary's Division, XII Corps) in the trenches under artillery fire. (Artwork from *Battles and Leaders of the Civil War*)



Map 1

up such a sustained, aggressive fight that Hooker once again lost his nerve. To the consternation of his commanders, Hooker ordered all units to give up their ground and retreat to the original defensive positions for the night. This second loss of initiative by Hooker, brought on by Lee's aggressive offense, is arguably where the Union lost the battle.

Despite taking up defensive positions around Chancellorsville, Hooker still felt confident that Lee would retreat due to lack of provisions, and, therefore, he concluded that Lee would not attack the strong Union defenses. If Lee surprised Hooker and caused him to lose his nerve on the first day, he would shock Hooker with his maneuvers the following day.

The third, and most important, critical event was Lieutenant General "Stonewall" Jackson's flank march across Hooker's front and into the Union right flank during the afternoon of May 2, 1863. Through the second day of fighting, neither side was able to gain an advantage. Stuart's reconnaissance reported that Hooker's right flank was extremely ill-prepared. After a careful estimate of the situation, Lee decided to send Jackson's entire corps of 28,000 men on a flank march, under the concealment of forest, to attack Hooker's right and move into his rear. This left Lee with only Anderson's and McLaws' divisions to fix the entire Union Army (Map 1). Despite the risk, Lee once again divided his army in the face of a numerically superior enemy. This time, however, his divisions marched across Hooker's front.

Although an unsound tactic, this type of calculated risk-taking made Lee a great general. During the twelve mile march, several Union units reported that a large force was moving across their front. Hooker took these reports lightly because he was convinced that Lee was in retreat. When elements of Hooker's III Corps seized tail units of Jackson's column, which included ambulances and other supply wagons, Hooker was totally convinced that Lee was in retreat.

By 1700, Jackson had his men in position and conducted his surprise attacks on the Union right flank (Map 2). Jackson's attack took Major General Oliver Howard's XI Corps by such surprise that Howard later commented, "... every sort of organization that lay in the path of the mad current of panic stricken men, had to give way and be broken into fragments." Sensing his momentum, and despite the fatigue of his men, Jackson was not going to halt his offensive at any cost. By evening, Hooker stabilized his lines and could only maintain his defensive perimeter around the Chancellor House. Thus, Lee successfully offset Hooker's numerical superiority through his maneuver and surprise. Despite Jackson's over-whelming success, Lee suffered one of his greatest losses of the war. While out checking his lines in the late evening, Jackson was accidentally shot and mortally wounded by his own men. Lee appointed Stuart to take immediate command of Jackson's corps. He did so with great success.

The final critical event was Stuart's seizure of the high ground at Hazel Grove and Fairview after Hooker abandoned it. On May 3, 1863, Confederate forces were still divided. Despite the success of Jackson's flank march, Lee knew he needed to unite his forces, drive Hooker from Chancellorsville, and regroup before fresh Union troops arrived from Fredericksburg. Therefore, he urged his commanders to "press the attack." Fighting was stiff throughout the day until Hooker abandoned all high ground during his retreat from Chancellorsville.

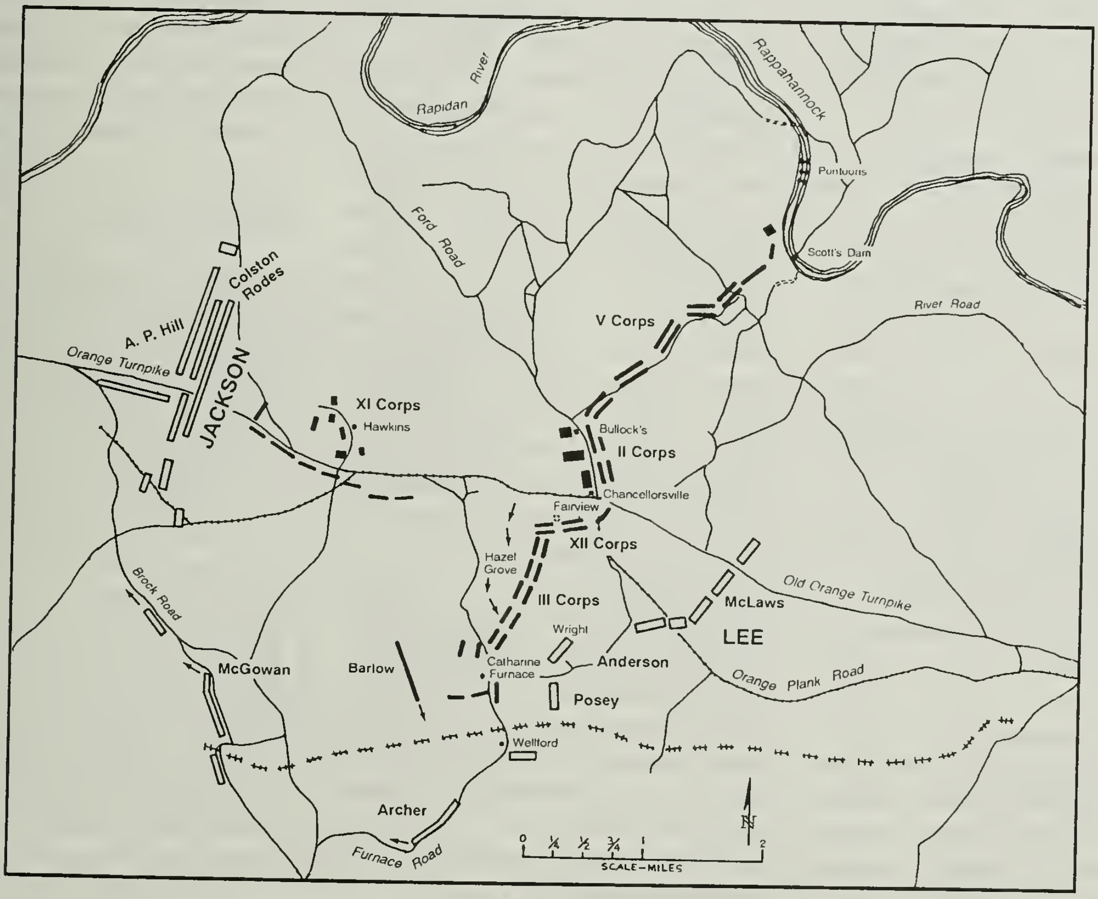
While Hooker attempted to strengthen his shrinking perimeter, Stuart seized the initiative and took Hazel Grove and Fairview. He placed his artillery on these positions and fired down on Hooker's retreating men, thus offsetting again Lee's disadvantage in men and artillery. Lee now occupied all the high ground around Chancellorsville, and his forces were united once again.

Hooker attempted to relieve his retreating forces by calling for his VI Corps to attack Lee. Lee, however, defeated this assault at Salem's Church on May 4, 1863. Thus, from May 4 through May 6, Hooker was in full retreat across the Rappahannock, and Lee was victorious. Nevertheless, it was a costly battle for the Confederacy. In addition to Jackson's death, Lee suffered 12,800 casualties, equalling twenty-five percent of his force.

Hooker, on the other hand, suffered 17,300 casualties in the rout, but this was only thirteen percent of his force. The Confederacy gained no real tactical advantage and would not be able to recoup its losses, but the battle was a great moral victory, and Lee immediately made plans to invade the North.

The Union, especially Lincoln, was devastated. The loss was another crushing blow to morale and support for the war. Lincoln's only solemn words were, "My God! My God! What will the country say?"

From the Chancellorsville battle, important lessons about the principles of war and tactics are evident and applicable to modern doctrine. When looking at the critical events, it is evident that Lee defeated Hooker by employing superior battlefield intelligence, an aggressive offense, and tactical surprise. Lee's cavalry was always at work probing Hooker's forces. It discovered the Union Army's initial crossings, as well as the ill-prepared Union right flank. These were undoubtedly decisive pieces of information in helping Lee make his decisions. Hooker, on the other hand, was virtually "blind" for the entire battle. His cavalry was nonexistent and he received little or no information about Lee's forces. If he had known the size of Lee's advance elements on May 1, 1863, he may have continued his attack. If



Map 2

Stampede of the XI Corps on the Plank Road. (Artwork from *Battles and Leaders of the Civil War*)

he knew that Jackson was not retreating during the flank march, he may have acted differently. At any rate, intelligence is crucial for every commander, especially on today's highly technical battlefield. Hooker lacked crucial intelligence, so he made uneducated guesses.

Lee epitomized the term "offense." It was his army's key to survival. During his initial contact with Hooker, during Jackson's flank march, and during his consolidation on the key terrain around Chancellorsville, Lee firmly believed in and pressed his commanders to maintain the offense. This paid great dividends for him because he continually maintained momentum, seized the initiative, and caused Hooker to constantly second guess himself.

Hooker, in turn, always reacted defensively, which further caused the momentum to sway in Lee's favor. The values of offensive tactics are evident through Lee's success. Lee used his offense to offset his severe disadvantages in men and artillery. Since current doctrine calls for fighting while outnumbered, commanders must be willing to gain momentum and initiative through constant offensive pressure coupled with quick maneuvers and calculated risks.

Surprise is an extremely effective principle, especially when it is coupled with offense. In addition to offsetting his numerical disadvantages with strong offensive tactics, Lee employed tactical surprise with equal effectiveness. Hooker never expected Lee to do anything that Lee eventually did, and Lee always had "something up his sleeve." From his immediate movement to meet Hooker on the first day to Jackson's flank march, Lee kept Hooker guessing. Part of employing surprise is taking risks, and Lee took many of them. It is evident in today's military that commanders who use surprise through calculated risks can expect the same results as Lee achieved.

When looking at Lee's success, it is also important to note that the principles of war and the tactics he used were interdependent. For example, Lee could not have achieved success during Jackson's flank march if he did not have the proper intelligence to devise the plan and, therefore, push his units to maximize their offensive potential. Commanders today must also understand that the principles of war and the tactics of war are most effective when they complement, augment, and support each other. By employing both aspects of war, commanders can greatly increase their combat power regardless of the circumstances.

History is our greatest teacher. Although the Battle of Chancellorsville took place over 130 years ago, Lee's actions still provide valuable and applicable lessons to today's commanders and for today's battlefield doctrine.

Great leaders such as General Lee are timeless, and the principles he applied at Chancellorsville will continue to be applicable on many battlefields of the future.

Lieutenant Vigna received the Engineer Officer Advanced Course Thomas Jefferson Writing Award for his Chancellorsville battle analysis. Before attending the course, he previously served as assistant S-4, company executive officer, and platoon leader for the 94th Engineer Battalion. He is a graduate of West Point.

Improving Combat Intelligence
With Engineer Scouts

By First Lieutenant Douglas Zaenger

During combat operations, getting accurate and useful tactical intelligence is critical to success. For a mechanized infantry or armor battalion task force conducting offensive operations, this means knowing where the enemy is—and how he is defending.

Items of critical importance include where the enemy's antitank missiles, tanks, dismounted infantry and artillery are located. It also includes an evaluation of the terrain for tracked and wheeled vehicle trafficability, potential kill sacks, key terrain and the enemy's integration of the terrain with his obstacles.

These engineer-specific items are critical pieces of the intelligence picture that the task force commander needs to make winning decisions. The problem is that he often doesn't get this information, and so doesn't get the complete picture.

The Shortfall

A mechanized/armor battalion task force's primary intelligence gathering asset is its scout platoon. Often, there is a critical shortfall in the engineer-related information gathered by the scouts. This information includes enemy obstacle intelligence on enemy obstacles; terrain as an obstacle and the trafficability of routes; and the effort and assets required to breach the obstacles and improve the trafficability of the routes.

One reason for this shortfall may be that the scouts are too busy trying to find and maintain contact with the enemy. They also may not be adequately trained to analyze engineer intelligence or the capabilities of friendly and enemy engineer units. As combat engineering becomes more sophisticated and capabilities improve, the scouts' lack of knowledge of engineer capabilities will become a more serious shortcoming. The solution to this problem is the creation of an engineer scout team.

The Engineer Intelligence Needed

During a zone clearing mission in support of a mechanized battalion task force movement to contact, a typical scout report on an enemy obstacle found on the axis of advance might be "There's a minefield at AB123456." If the scouts cannot get close enough to get any more information than this, then the report will have to do. But it is almost useless. If more detailed information on the obstacle is not gathered, critical tactical intelligence has been lost. Needed information includes:

- The type of obstacle
- The endpoints of the obstacle
- Its overall depth
- Determining if it is complex (combination of different obstacles into a single system)
- Number of belts
- Determining if the mines (if any) are buried or surface laid
- Determining if the mines are pressure, tripwire, or tilt-rod activated

With this information, along with knowledge of the terrain and the enemy's weapons capabilities (maximum effective range, and destructive potential), the scouts can evaluate the enemy disposition. The combination of obstacles, terrain and enemy weapons capabilities, as seen by the scouts on the terrain, puts them in the best position to evaluate the enemy's defenses and identify his weakest or most vulnerable points.

If breaching is preferred over bypassing an obstacle and the breach force isn't adequately task organized, additional troops and equipment can be identified and linked up with the breach force. They will then be able to breach the obstacle efficiently and move on with the mission. In some cases, the scouts

Engineer augmentation of scouts can provide valuable information to the maneuver commander. Joint training of engineers and scouts, as here during a field exercise, is critical to the success of this team.

may be able to breach the obstacle. This could eliminate the need for an instride breach and significantly aid the attacking task force.

Ad Hoc Lash-Up Solution

Presently, the scouts don't seem to possess the capabilities (technical skills or time) to give adequate attention to engineer-related tasks. One solution is to augment the scout platoon with combat engineers, who can provide both technical expertise and time-saving assistance.

Without an established structure or any kind of doctrine governing their employment, though, this ends up being a marginally effective ad hoc "lash up." During two deployments at the National Training Center (NTC), I observed this lash up in practice. It was discussed by the task force battle staff prior to the deployment, but only in general terms. No integration planning or specific tasks or missions were discussed until we began preparing an offensive operations order in the desert.

The use of engineers with the scouts under these conditions was only marginally successful. But the little success we had showed how valuable a formal engineer scout organization could be. Besides providing technical expertise in evaluating enemy obstacles and the terrain, the engineer scouts were able to breach obstacles without detection before the main body of the task force arrived. When such breaching was possible, it denied the enemy an opportunity to mass fires on the task force.

Key shortcomings of the scout/engineer lash up at the NTC were 1) the scouts and engineers never trained together and didn't know each others' capabilities, SOPs, or battle drills; and 2) riding in the back of the scouts' Bradleys prevented the engineers from being proactive by reporting observations that the scouts missed or ignored. To overcome these shortcomings, I recommend that units establish formal engineer scout teams.

The Engineer Scout Team

The engineer scout team concept makes available an experienced team of combat engineers, who train with habitually associated battalion task force scouts, to augment the scouts during combat operations. With the Engineer Restructure Initiative providing each of nine maneuver battalions with their own habitually associated combat engineer company, it becomes practical. It is also practical within the limits of the new engineer company TOE.

Two courses of action (COAs) can be used to create the engineer scout team. It could be a separate organization under the engineer company headquarters, or it could be a line squad detailed as the company's engineer scout team. The decision criteria used for choosing a COA are:

- The COST of new equipment needed to equip the team (either taken from elsewhere in the company or added to the company's authorization and purchased).
- PERSONNEL needed to equip the team (either taken from a platoon or added to the company's authorization).
- Availability of TIME for scout TRAINING.

COA Comparison

	Cost	Personnel	Training Time	Availabilty
COA 1	$25,599	-	+	+
COA 2	$12,454	+	-	-

- AVAILABILITY of the team on the battlefield (competing missions for a single element).

COA 1: Scout Team as Part of the Company Headquarters

This COA makes scout operations the team's full-time occupation and eliminates competition for time between scout and engineer squad training. The drawback, given that the team is equipped and manned from within the existing company TOE, is that a vehicle and personnel must be allocated to the team.

I recommend that the vehicle be a HMMWV. It can keep up with Bradleys better than the M-113, and with a ballistic shell and doors (M1025 Weapons Carrier) it provides protection against small arms fire and shell fragments. Since neither the M-113 nor the HMMWV is in the same class of combat vehicle as the Bradley, engineer scouts should not be used in direct fire engagements.

The personnel for this scout team are an NCOIC, an assistant, and a driver. The major equipment required, in addition to the HMMWV, are a secure 2-net radio set (AN/VRC-46 and AN/GRC-160), three CVC helmets and associated installations kits (to improve communications among the crew), two AN/PRC-127 radios, GPS (global positioning system), demolition kit and either an M-60 MG or MK-19 grenade launcher (for the M1025 weapons station).

The cost of these items (excluding the M1025) is approximately $22,313. The cost of an M1025 (M998 with ballistic shell and weapon station) is $33,180; the basic M998 costs $28,894. The difference is $3286. The final cost of exchanging one of the company's M998s for an M1025 is $25,599. The final cost of adding an M1025 to the company's TOE is $55,493.

COA 2: Line Squad Detailed as the Engineer Scout Team

This COA makes scout operations the squad's secondary mission. No vehicles or personnel are diverted to the team and the only new equipment requirements are the GPS, a second secure radio (AN/VRC-46), and two AN/PRC-127s. The cost of this equipment is $12,454.

A disadvantage of this COA is the need to balance training time between the scouts and engineer squad training. Also, only one mission can be performed at a time, forcing a choice between using the squad as line combat engineers or as scouts.

Comparison of the Courses of Action

The matrix shown above shows the strengths and weaknesses of the two COAs. The cheapest solution is COA 2. However, COA 1 has significant strengths: consistent mission availability of the engineer/scout team, and full-time engineer/scout training.

Summary

One of the keys to success on the battlefield is good tactical intelligence. Unfortunately, one of the most glaring shortfalls in this area is engineer-related intelligence. This is because scouts, while possessing some basic engineer training, are not technically proficient at combat engineer skills. Additionally, the scouts are overtaxed by their primary missions of finding the enemy, maintaining contact with the enemy and reporting to the task force.

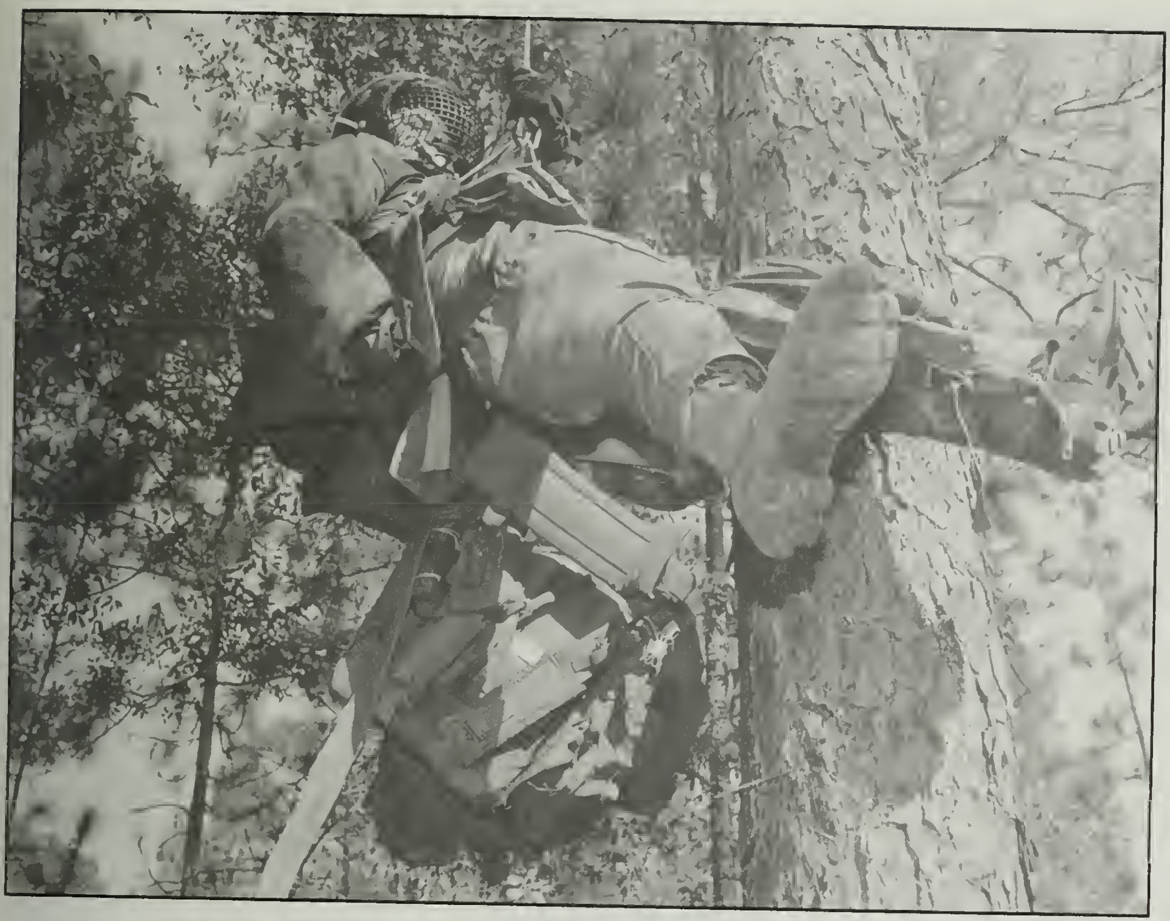
A solution to correct this shortfall is the creation of an engineer scout team. To create this team, we must develop the combined arms doctrine for the integration of the engineer scout team with the cavalry scouts and establish a company engineer scout team TOE.

Now is the time to create and implement the engineer scout team. Without it there is a critical shortfall in the engineer-related intelligence gathered. Without this information the maneuver commander doesn't have all of the information needed to make winning decisions. With this information the task force's chances for victory are greatly improved.

First Lieutenant Zaenger was the S-2 for the 3rd Engineer Battalion (Combat). He previously served as a platoon leader for the battalion. He is a graduate of the Engineer Officer Basic Course and Carnegie Mellon University, where he earned a B.S. in civil engineering.

Engineers in Rough Terrain Airborne Operations

By Captain William E. Rapp



Above: Using his nylon rappelling line, a rough terrain jumper lowers himself from a treetop "hang" position. (Photos by Staff Sergeant Mark Martello)

Opposite page: A Bravo Company paratrooper practices lowering procedures during tower training.

While rough terrain jumping is often associated with special operations units or civilian "smoke jumpers," Army engineers also use this technique to support a variety of operations.

The rough terrain airborne mission for engineers is relatively simple. In a typical scenario, a rough terrain engineer platoon jumps into a remote, forested area far from established roads or airfields. Their mission is to clear a helicopter landing zone capable of handling CH-47 helicopters or other fixed-wing aircraft.

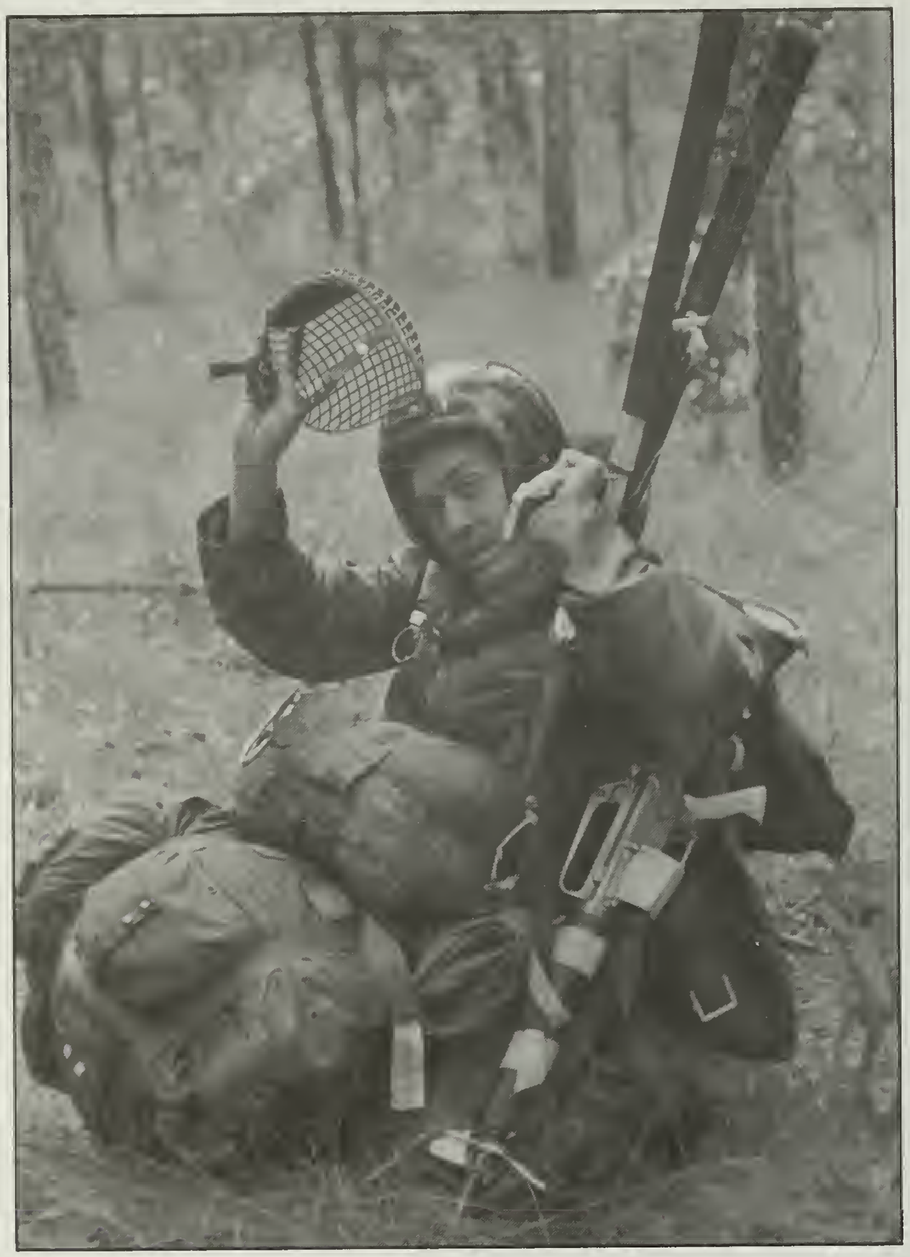
Initially, a small clearing is created, using chain saws and demolition charges brought in with the jumpers. Small bulldozers are then lowered in by the cargo helicopters. The engineers use the dozers to clear back the treeline until a multi-pad landing zone is prepared. The site can then serve as a forward staging area for infantry, reconnaissance, or anti-drug operations.

Rough terrain jumpers can use C-130 and C-141 aircraft, but rotary-wing aircraft like the UH-1, UH-60 and CH-47 may be more suitable depending on the terrain. Using steerable MC1-1B parachutes, jumpers group near designated leaders during their descent. Close-grouped landings, aimed at earlier equipment drops, facilitate rapid team assembly and mission accomplishment.

Contrary to normal airborne operations, the objective during a rough terrain jump is to become hung high in a tree and avoid landing on the ground. Using his steerable parachute, a jumper will aim for thick stands of trees, and attempt to "hang" his chute from high tree branches.

Once the chute catches the top branches of a tree and the jumper is suspended, he gets ready to rappel to the ground. Using a 120-foot tubular nylon line stored in a leg pocket of his protective suit, the jumper ties off to his parachute risers. He then prepares the line for rappelling, using a snaplink, and dons heavy gloves. Releasing himself from the parachute harness, he lowers himself slowly to the ground. The line, which is still tied securely to the parachute, will help in recovering the chute later.

Such procedures require highly specialized training. The base proponent for rough terrain parachuting is the U.S. Forest Service's Smokejumper School in



One of the dangers of rough terrain jumping is failing to "hang" in the treetops. Here, a rough terrain student starts to de-rig after coming through the trees.

Missoula, Montana. Most Special Forces rough terrain jumpers are products of the two-week course. However, the instruction is prohibitively expensive for large numbers of jumpers—those in an engineer company, for instance. For large groups, rough terrain jumping is taught through in-house courses. Often, the instructors for these courses are Smokejumper School graduates.

The unit-sponsored training course takes three days to complete. The engineer specialties selected for rough terrain include combat engineers (12B) and engineer equipment operators (62E). Each student receives training in rough terrain techniques, equipment, parachute control, and tree rappelling. Actual rough terrain jumps cap the training program.

From a trainer's perspective, rough terrain parachuting presents many challenges. Jumping into trees requires that soldiers be extremely well trained on canopy control and aiming techniques, correct tree landing positions, and rappelling from a tree.

The rappel from the tree is potentially the most dangerous phase of the operation. Each student must demonstrate his ability to rappel from a hang position on a rappelling tower.

The rough terrain parachutist's M16 rifle is rigged exposed, that is, without a protective weapons container, and the rucksack is not lowered prior to landing. This makes it safer for the jumper to become hung up in a tree, and avoid a ground landing where his equipment might cause injuries. These techniques are not natural for an experienced jumper and require careful attention during training.

Special equipment is required to protect the jumpers. A modified motorcycle helmet with heavy wire or plastic mesh face cover protects the jumper without degrading his vision. A special two-piece nylon jump suit with foam padding on major impact points provides body protection. The top of the suit has a large padded collar to prevent branches from jamming up under the jumper's helmet. A B-7 life preserver is also worn. While it's bulky, it can keep a fully loaded jumper afloat if he lands in water.

The rough terrain parachuting mission for engineers is a highly specialized and valuable capability. The ability to get combat engineers into remote sites allows rapid force projection and sustainment. With the Army making contingency operations a priority, rough terrain airborne engineers will continue to see plenty of action.

Captain Rapp has served as the training officer, 27th Engineer Battalion. Previous assignments include executive officer and assistant S-3, 16th Engineer Battalion. He is a graduate of the U.S. Military Academy, the Air Assault Course, Basic Airborne Course and Jumpmaster Course.

(Book Review continued)

Japan is in much the same predicament in 1992 as she was in 1941. And in some ways her external environment is more hostile now than it was then. Today Japan is more dependent on international suppliers of raw materials than they are on her finished products. Japan's strategic partnership with the United States is declining, and she seems destined to become a world military power again.

Cassandra, in the Trojan legend, had the power of prophecy but no one believed her. The authors of *The Coming War With Japan* take a Cassandra-like attitude. They state in the preface that the prediction of an imminent war between the United States and Japan "is bound to be ridiculed by the conventional among us." The book does not deserve ridicule but should be read with caution because it contains some flaws in logic.

A major flaw is their inadequate treatment of Japan's "China Problem." Japan must come to terms with the Chinese threat before she can seriously consider the United States to be an enemy. China is organized as a unitary state with a sense of purpose that would have terrified Japanese statesmen in 1931 (and has scarcely less impact in 1992). Chinese interests are clearly divergent from those of Japan. Japan's growing antisubmarine capability is in response to the Chinese submarine threat.

The authors also fail to acknowledge the impact of post-World War II independence movements of those states whose membership would be required in a new Greater East Asia Co-Prosperity Sphere. The 1941 appeal to French Indochina, British Malaya, Dutch East Indies, and American Philippines, is no longer relevant. In fact, the Japanese, by their brutal treatment of fellow Asians, have left an enduring legacy of distrust, if not outright hostility.

In 1941, the Japanese failed to appreciate American production capability. Their assessment was understandable—the U.S. did not appear capable of organizing her industrial base. For example, between 1922 and 1937, the U.S. launched only two dry cargo ships. Who would believe that, at the peak of the battle of the Atlantic (March 1943), American shipyards would launch 140 Liberty ships in one month! The Japanese are unlikely to underestimate American production again.

As a final consideration of why war is not imminent, one must think of the enormous investment in ballistic missile defenses that Japan would require. By 1945 Japan knew that she could not defend herself from air attack. The world-wide proliferation of ballistic missiles must concern the Japanese because their densely populated islands are highly vulnerable. Japan does not appear to be seriously considering fielding a missile "umbrella."

The authors recommend a defense strategy for the United States. They recommend that "the U.S. must slash the United States Army," employ U.S. Army troops primarily as "garrison forces," and "use the savings from Army cuts to build a Marine Corps at least twice its current size." Admittedly, it was hard for this reviewer to objectively consider such a proposal. The 1992 edition of National Military Strategy has shifted the focus of our preparedness from a global war to regional conflicts. But there are more regions than the littoral reaches of the Pacific, and certainly more cogent threats than Japan.

For all its faults, I recommend reading *The Coming War With Japan*. The authors did extensive research, and they have dissected and masterfully explained complex ideas in a very readable style. While no single idea presented is impossible, some strings of ideas are highly improbable. Read the book, but be careful the authors do not sell you something that you do not wish to buy.

Reviewer: *Jeb Stewart is an analyst in the Concepts Branch, Directorate of Combat Developments, U.S. Army Engineer School. He has a bachelor's degree from Virginia Polytechnic Institute, and is a masters degree candidate at Southwest Missouri State University.*

Expanding Productivity By Trying Something Different

By Second Lieutenant Dean W. Kucera

> "In the current climate of reduced military spending, units need to find ways to minimize costs and maximize efficiency."

In a recent deployment to California, Bravo Company, 34th Engineer Battalion, Fort Riley, tried out some new techniques and products during a construction project. As a result, they increased productivity and cut costs at the same time. This article outlines the site preparation project for the Riverside Police Department, and describes some of the ideas that helped the mission along.

Bravo Company's mission was to prepare the construction site for the Riverside Police Department's new facilities at the Riverside Municipal Airport. The new facilities will house the Police Department's special services department and aviation unit.

Excavation began on April 7, 1992, and site preparation was completed on May 26. More than 5,000 cubic yards of earth were moved every day, using five scrapers and four dozers. In all, the company moved 140,000 cubic yards of earth in about 28 work days.

Four new techniques and products were used in an attempt to increase productivity:

- New staking techniques
- Headset radios for directing operators
- Carbide coatings for cutting edges
- Re-grousing dozer tracks

Staking

Prior to the start of construction, the 15-acre worksite was surveyed by an advance party, and 300 stakes were placed on 50-foot by 50-foot grids. The surveyor who laid out the stakes used a unique method to mark them.

The Riverside project called for cuts up to 27 feet deep and 8-foot fills. To quickly and easily identify the range of cut or fill from a distance, the stakes were marked with different colored flagging. Red flags showed a change in elevation of more than 10 feet, orange flagging between 5 and 10 feet, yellow between 1 and 5 feet, and blue within 1 foot of grade.

This marking system was effective in giving operators and site NCOs a quick visual reference of how much to cut or fill. The system also helped leaders plan daily operations without having to constantly refer to individual stake markings. On a site of this size, this was a significant time saver.

Headset Radios

Shortly after the project began, the squad leaders and platoon sergeants talked about the potential advantages of communicating with the equipment operators while they worked. With the battalion commander's approval, 12 headset radios were purchased to test this concept. Purchased from a local electronics store, the headsets had a quarter-mile range, which was perfect for the project.

The radios were worn by scraper operators, water-truck operators, the cut-site NCO, and the fill-site NCO. These radios allowed supervisors to more efficiently direct the cutting, filling, and watering operations. Additionally, mistakes-in-progress could be corrected quickly, and praise for good work could be doled out on the spot.

Surprisingly, the radios also helped with maintenance. The site NCOs could often spot a leak or problem on the equipment that the operator could not see. The NCO informed the operator immediately so the equipment could be shut down and repaired before any serious damage occurred.

Esprit de corps also got a shot in the arm from the headsets. Operators could talk to each other and break the sometimes tedious nature of the work. Good-natured competition about the quality of work done by each operator was broadcast" over the headsets. This served to bolster both the progress of the project and the quality of the work.

The Riverside project site as it appeared on April 21, 1992.

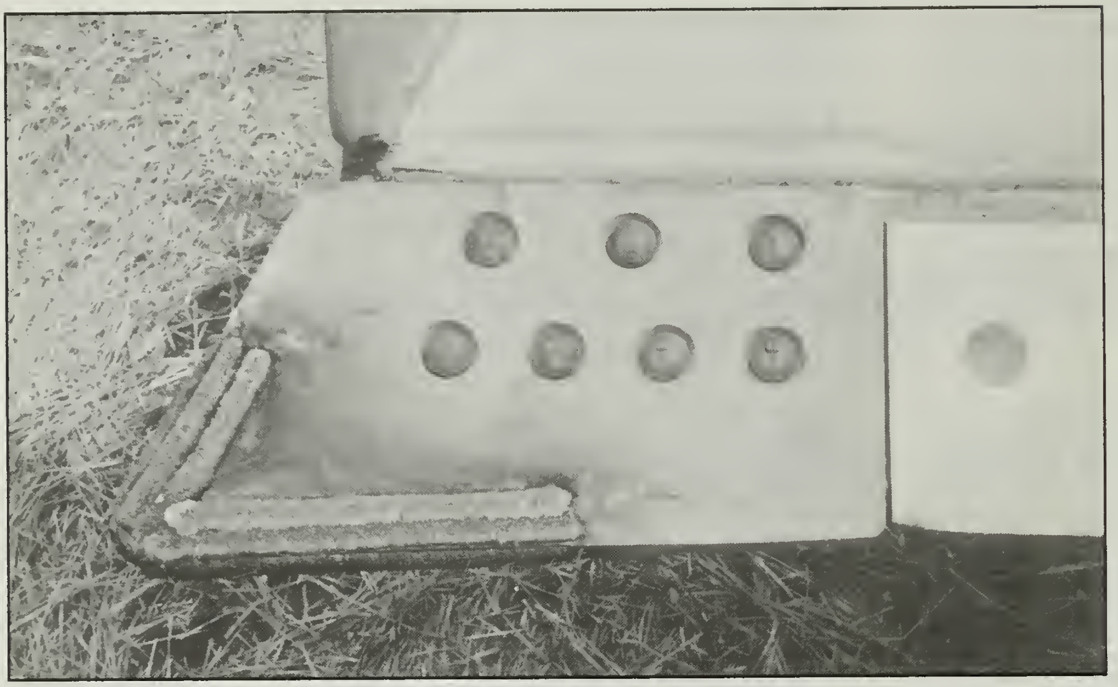
Durability was a problem with the headsets. The transceiver worked well, but the headsets were not durable enough for the rough construction work. The noise of the D7G dozer made it difficult for operators to use the headsets effectively.

While the headsets were a great success, improvement was needed in the models used. For maximum effectiveness, the speaker and microphone should be mounted in a set of durable headphones, muffled against exterior noise. With increased durability and soundproofing, such headsets could increase productivity and morale, and contribute to maintenance and safety programs.

Carbide Coatings

Early in the project, a visit to a local construction equipment dealer revealed that they often welded carbide chips onto the cutting edges of equipment in order to increase the wear life of blades and bits. Bravo Company decided to test the coating on the cutting edges of the 621B scraper, the end bits of a D7G, and the ripper caps on a D7G.

The coating is achieved by using a welding process and ground up



Top: Carbide coating on a D7G dozer end bit.

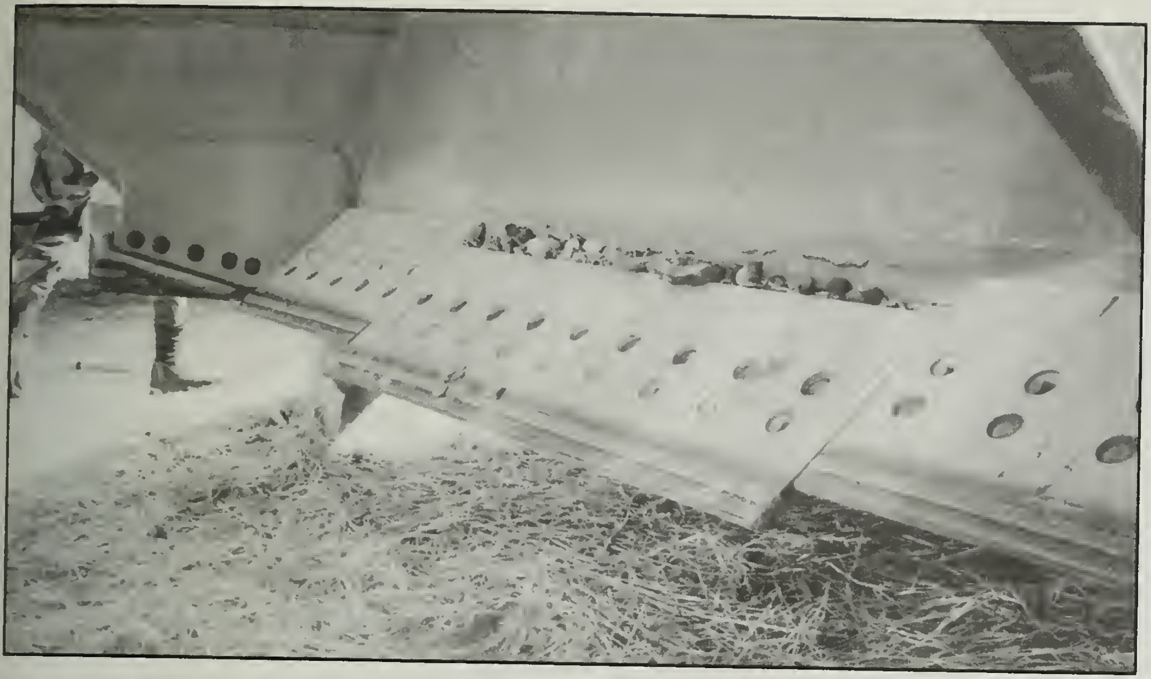
Above: A cut side on April 9, 1992. Cut depths in this area ranged from 1 foot to 12 feet.

carbide steel chips from drill bits on the outer edge of the cutting surfaces. On the Riverside site, the soil was primarily decomposed granite (DG). This highly abrasive soil made a good testbed for determining the usefulness and cost effectiveness of the carbide coating.

For the test on the 621B scraper, standard cutting edges and router bits were mounted on one scraper, and carbide-coated edges were installed on another scraper. The equipment operators then counted the number of loads they cut. After 650 loads, the standard edges showed an average 2 inches of wear on the end bits and 3 inches of wear on the center (stinger) bit. The carbide-coated edges showed no appreciable wear.

The scraper with the standard edges used three sets of cutting edges to complete the project. By the end of the project, after 3,000 loads and six weeks of work, the carbide edges still showed only minor wear.

For the D7G test, Bravo Company mounted one carbide end bit and one standard end bit. After six weeks, the standard bit had 1 to 2 inches of wear, with rounding of



Carbide coated cutting edges on a 621B scraper.

the outer edge, while the coated edges showed only minor wear. The D7Gs on this project were used primarily for pushing scrapers—not for digging. And even with the light digging duty encountered in this project, the carbide advantage was clear. The results of the test on the ripper caps were similar.

The carbide coating cost $1.61 per linear inch. Cost comparisons are shown below.

Based on the wear data, the additional cost of carbide coating is worth the price. The carbide coatings also saved equipment down time normally devoted to changing worn cutting edges or waiting for replacement edges. In locations where the soil is abrasive, the coatings will allow a unit to remain mission capable for longer periods.

The only drawback to the carbide, according to the equipment dealer, is a tendency for the coatings to chip when the cutting edges hit rocks.

Re-grousing

At the start of the project, all of the unit's dozers had only about one inch of track left on the track shoes. Tracks with that much wear will diminish the effectiveness of dozers in digging or pushing missions. Because of this wear, the unit had the tracks re-groused. This simply means that the life of the existing track shoes is extended by welding new strips of metal onto each track shoe.

The re-grousing process took two days at a local equipment dealer. The rebuilt tracks performed well, and showed no signs of chipping or breaking. The cost of the re-grousing was $1,500 per dozer, including materials and labor. The cost of a new set of track shoes is $2,700—not including the cost of labor.

From Bravo Company's experience, the re-grousing was cost-effective. If re-grousing is accomplished at direct support maintenance, costs will be reduced even further.

Conclusion

In the current climate of reduced military spending, units need to find ways to minimize costs and maximize efficiency. The Riverside project gave the 34th Engineers the opportunity to demonstrate the kind of ingenuity and planning that saves money and still gets the job done.

Second Lieutenant Kucera is an earth moving platoon leader for Bravo Company, 34th Engineer Battalion. He is a graduate of the Engineer Officer Basic Course and the University of Nebraska, where he earned a bachelor's degree in construction management. A former enlisted engineer, he previously served as a heavy construction equipment operator for the 7th Engineer Brigade.

Cost Comparison for Cutting Edge Sets

	Carbide	*Standard*
621B Scraper-1 center bit, 2 edge bits and 2 router bits	$1,361	$754
D7G dozer-2 end bits	451	213
D7G dozer-3 ripper teeth caps	337	225

Lessons Learned

Small Emplacement Excavator (SEE) Operations

The following lessons learned apply to Army engineer and explosive ordnance disposal (EOD) units that use the Small Emplacement Excavator (SEE) in training or combat. They are based on results of a post-fielding training effectiveness survey and observations made during Operations Desert Shield and Desert Storm. For more information, write to Commandant, U.S. Army Engineer School, ATSE-ESA, Fort Leonard Wood, MO 65473-6630. Or, call (314) 563-5305, DSN 676-5305.

The Small Emplacement Excavator (SEE) has been completely fielded to designated Army engineer and explosive ordnance disposal (EOD) units. The vehicle, which performed well in Operations Desert Shield/Storm, is used extensively in construction operations and the performance of tasks supporting combat operations. Observed operational problems will be difficult to fix through materiel changes because the SEE was procured as a non-developmental item. Proper training will enhance operators' skill and confidence and lessen the hazards associated with vehicle operation. The following information will help your unit achieve optimum production from your SEE fleet.

ISSUE: The SEE has a tendency to roll over.

DISCUSSION: Of units surveyed, 23 percent experienced roll-over accidents when operators turned corners or drove the SEE on side slopes or uneven terrain. The

By Peggy McAvenia and Sergeant First Class Greg Copas

potential for roll-over accidents adversely affects operators' confidence in their performance. The absence of ground guides and excessive speed increase the potential for roll-over accidents.

LESSONS LEARNED: To gain confidence in their skills, units must provide SEE operators ample "behind the wheel experience" on uneven terrain and side slopes. Ground guides should be used to alert operators of potential roll-over sites. For safe operation, a maximum speed of 8 kilometers per hour or 5 miles per hour (8kph/5mph) must be observed when maneuvering across uneven terrain.

ISSUE: The size of the SEE's cab restricts movement and provides limited storage space.

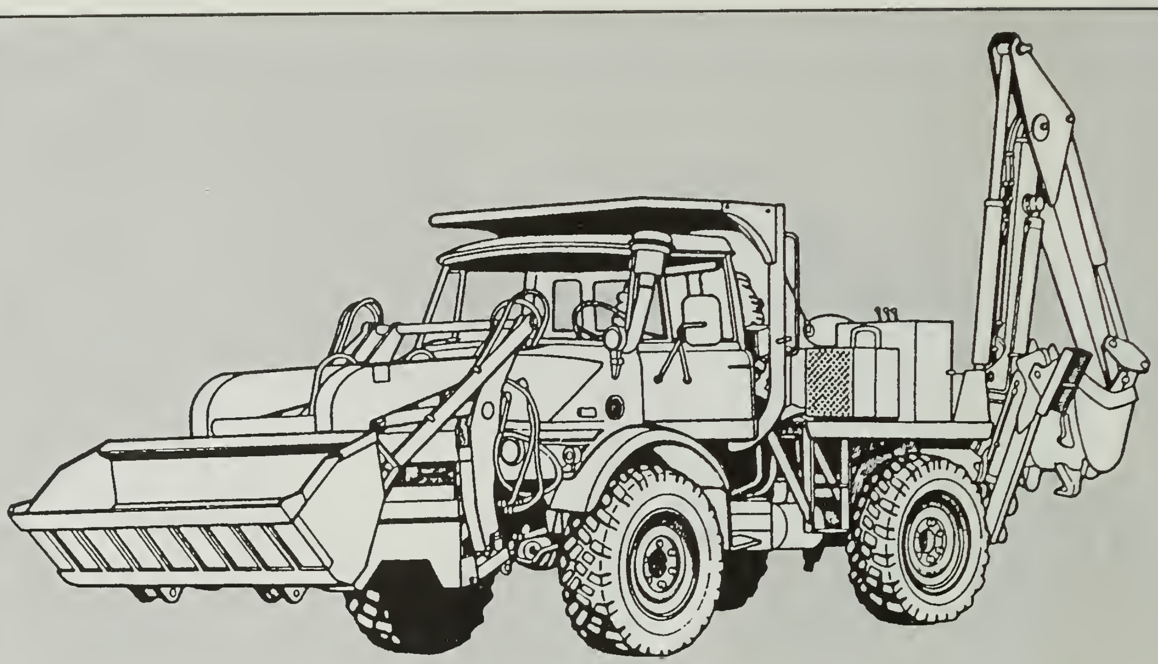
DISCUSSION: While the operators' compartment in the SEE is small, it will not be redesigned. All operators have experienced difficulty when performing tasks in MOPP IV and arctic gear. Some operators have difficulty operating the controls: they continually bump their heads, elbows, and knees. Other operators experience cramps and reduced response rates, which eventually leads to operator fatigue. The cab also lacks space to store personal equipment such as CTA-50, protective masks, and weapons.

LESSONS LEARNED: Units must provide ample training opportunities for operators using MOPP IV and arctic gear. Supervisors must continually check SEE operators for fatigue, which could contribute to an accident. When a second seat is not required in the cab, consider removing the passenger seat to create additional storage space.

ISSUE: The SEE cannot ascend or descend a 60-percent slope.

DISCUSSION: In a recent test, 51 percent of the SEE operators were unable to ascend or descend a 60-percent slope. The test required operators to start the SEE on a 60-percent grade and climb on a surface free of loose material. The test was conducted on a dry concrete surface under ideal conditions. (In the field, most SEEs operate under conditions much worse than the test conditions.) Most of the operators tested could ascend a 60-percent slope but could only descend a 50-percent slope safely. The major reason for test failure is the weight distribution of the front bucket and backhoe. Also, some operators attempted to negotiate slopes at excessive speed, creating a stall condition and an unstable situation.

LESSONS LEARNED: Supervisors must identify routes at the jobsite that ascend or descend a slope with less than a 50-percent grade. Operators must be trained to select the correct gear when negotiating a steep grade and maintain that gear throughout the climb. Operators MUST NOT de-clutch on a severe



Small Emplacement Excavator (SEE)

grade! Furthermore, operators must always drive the SEE at slow speeds (less than 8kph/5mph) when maneuvering on unimproved surfaces at the jobsite.

ISSUE: The SEE lacks sufficient power to dig with the front bucket.

DISCUSSION: The front bucket on the SEE is designed only to load or backfill loose soil. It is not designed to excavate banked or compacted soil, and numerous front-bucket failures occur when operators try to perform these tasks.

LESSONS LEARNED: Supervisors must ensure that the front bucket is used only for its designed purpose. Operators must know the limitations of the front bucket and use it only to move loose soil.

ISSUE: The backhoe stabilizers will not hold the SEE on side slopes.

DISCUSSION: Supervisors and operators report that the backhoe stabilizers will not hold the SEE in place when they maneuver on side slopes, especially when the bucket is moved to the downhill side of the slope. Initial production tests show that the SEE cannot operate satisfactorily on side slopes greater than 20 percent because the maximum leveling angle of the stabilizers is 10 degrees.

LESSON LEARNED: When backhoeing on side slopes, operators must excavate and dump material on the uphill side of the slope from the vehicle's centerline.

ISSUE: Mechanical problems increase when nonqualified personnel operate the SEE.

DISCUSSION: Some mechanical problems occur because SEE operators do not follow established procedures. This is especially apparent when personnel other than military occupational specialty (MOS) 62J operate the SEE. Specific problems caused by nonqualified operators include burned out starters and burned out clutches.

LESSONS LEARNED: Units must ensure that the SEE is operated only by qualified personnel (MOS 62J). When missions require that other personnel operate the SEE, supervisors must ensure that they follow proper operating procedures at all times.

ISSUE: Rust, corrosion and condensation occur in the SEE's air system.

DISCUSSION: Survey responses indicate that problems with rust, corrosion and condensation in the air system are common. These problems probably occur because of improper preventive maintenance checks and services (PMCS) and improper maintenance supervision.

LESSONS LEARNED: Supervisors must ensure that the air tank is drained daily and the alcohol evaporator system is serviced daily. Operators must ensure that the seasonal switch is on the correct setting for current climatic conditions.

ISSUE: Periodic maintenance services on the SEE are performed late because of inaccurate hour gauge readings.

DISCUSSION: The mechanical-electrical hour gauge on the SEE is difficult to read. The gauge is mounted outside the cab at an inconvenient location and the two sets of numbers are poorly displayed, making it difficult to read. Many operators assume that the red numbers record tenths of an hour when they actually record hour increments. Because of these difficulties, operators frequently guess at operational times rather than read the instrument. As a result, the intervals between periodic services are too long, causing mechanical failures and performance problems.

LESSONS LEARNED: Supervisors must ensure that the operational hour gauge is read accurately in spite of the difficulty with access. Operators must be trained to read the hour gauge correctly.

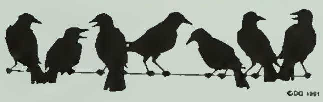
ISSUE: The primary fuel filters on the SEE clog before the recommended scheduled maintenance interval.

DISCUSSION: Of maintenance supervisors surveyed, 61 percent report that the primary fuel filters on the SEE clog before the scheduled maintenance. Corrosion in the fuel tank contributes to fuel-filter clogging.

LESSON LEARNED: Alleviate the problem of clogged fuel filters by draining the primary fuel filter daily and topping off the fuel tank after operating the SEE. If the problem persists, replace the factory-installed fuel tank with an aluminum tank that is available under the same parts number.

Mrs. McAvenia is an education specialist assigned to the Directorate of Evaluation and Standardization, U.S. Army Engineer School.

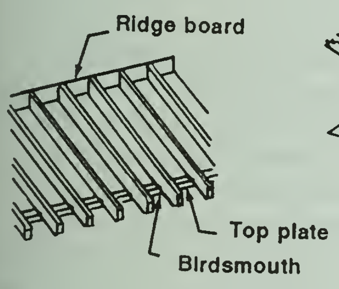
Sergeant First Class Copas is an action officer assigned to the Directorate of Combat Developments, U.S. Army Engineer School.

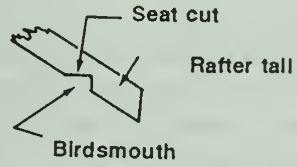


How Big is a "Birdsmouth"?

By Les Fortner

For those suddenly thinking of a creature with feathers, a birdsmouth is that part of a common rafter which sits on top of, and is anchored to, the upper wall framing member of a building (the top plate), as shown below.

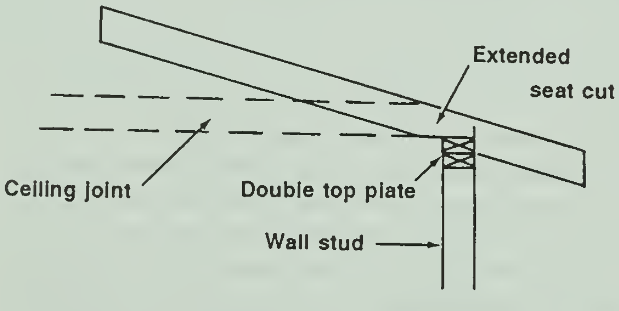




Department of the Army Field Manual 5-551, *Carpentry*, February 1984, indicates the seat cut should equal 3 5/8 inches or the width of the top plate. A seat cut equal to the width of the top plate is satisfactory for a roof pitch of 4:12. However, as the pitch of the roof is increased, the width of the seat cut must be decreased. Otherwise, the tail of the rafter will be weakened to the point of possible roof failure.

When laying out cuts for common rafters, adjust the length of the seat according to the pitch of the roof. As a rule of thumb, 50 percent of the rafter stock should be left to support loads of ice, snow, construction materials or workmen.

The illustration below depicts the cutting of a birdsmouth for a building to be constructed with a flat ceiling and a roof pitch of 3:12 or less. This includes shed type roofs. On this roof structure, the length of the seat cut must be greatly increased to eliminate an obstruction when the flat ceiling is installed.



In conclusion, adjust the size of the birdmouth depending on the pitch of the roof but *never* cut away more than 50 percent of the rafter stock's width.

Mr. Fortner is a training specialist in the Directorate of Training and Doctrine, U.S. Army Engineer School.

Engineer Support to *Reconnaissance*

By Captain Thomas W. Kula

Engineers are the experts in obstacle reconnaissance. They are the ideal augmentation for the scout platoon in offensive reconnaissance missions. Yet, observations of task force (TF) operations at the Joint Readiness Training Center (JRTC) show that engineers are not effectively integrated into the TF recon effort.

Doctrine stresses engineer involvement in reconnaissance for offensive missions. Unfortunately, TF commanders are not effectively using this expertise. This article provides some ideas on why this is happening. Two offensive missions from JRTC scenarios are presented to illustrate how engineers can be effectively used to augment the recon effort.

(The JRTC, located at Fort Chaffee, Arkansas, provides advanced training for light, airborne, and air assault [LT, ABN, AASLT] task forces.)

Engineer Support to Light Forces

To understand engineer support within LT/ABN/AASLT divisions, one must first understand that an engineer company normally supports a LT/ABN/AASLT infantry brigade. Normally, an engineer platoon supports a battalion-sized TF. In airborne and air assault divisions, one platoon is regularly associated with a maneuver battalion. Within light divisions, a two-platoon company supports the brigade's three maneuver battalions on an area basis—or by priority for the offense.

While engineer support to LT/ABN/AASLT divisions is increased when corps engineers augment divisional engineers, the brunt of engineer support to maneuver battalions for the offense is provided by divisional engineers. In LT/ABN/AASLT divisions, the L-Series Table of Organization and Equipment (TOE) stipulates an engineer captain as the brigade engineer.

In the task force, the TF engineer is also the platoon leader of the engineer platoon. One engineer lieutenant and three engineer squads may not seem like a lot to the casual observer. But the TF commander knows that this platoon is a vital combat multiplier and uses it often and effectively in the offense—he doesn't just hold it in reserve, waiting for the defense.

Missions

The two offensive missions outlined here are deliberate attacks. The first is a TF mission to infiltrate forward enemy defenses and secure an enemy-fortified position in order to support the passage of a heavy task force. The second is a TF mission to infiltrate and destroy a regimental command post (CP).

Before discussing recommended engineer support to these two missions, it's important to list some common TF deficiencies in planning engineer support to reconnaissance.

Engineer Planning

Engineer planning for operations, like other battlefield operating systems planning, supports the tactical planning process. For offensive missions, the TF engineer analyzes the factors of METT-T (mission, enemy, terrain, troops, and time available) during the engineer estimate process. He also recommends the amount of engineer support provided for the recon effort.

Observations

Regardless of what the TF engineer recommends—or how extensive the reconnaissance effort is—many TF commanders either (1) do not augment the scouts with engineers, or (2), more commonly, augment the scouts with only two engineers to "check the block." Some observations on why engineers are not effectively included in the reconnaissance are:

- TF commanders that don't task organize engineers to the scouts may not realize that engineer expertise can provide the detailed obstacle intelligence (OBSTINTEL) collection that is critical to breach planning.
- Minimal engineer support to reconnaissance generally means the TF commander doesn't want to risk losing his engineers. However, lessons learned show that poor obstacle recon results in failed breaching operations, and the collection of critical OBSINTEL is worth the risk.
- The TF commander is reluctant to attach engineers to the scouts because they have not trained together. This is a valid point—but only shows that such training should have been accomplished at home station.

The Army Research Institute conducted a study in 1989 of 47 TF offensive missions at the National Training Center (NTC). Certain variables were analyzed (OBSTINTEL, rehearsals, breach planning) to determine their effect on breaching operations.

When OBSTINTEL was collected during recon and other variables were not considered, 75 percent of the breaching operations were successful. In breaching operations where OBSTINTEL was not conducted, breach effectiveness averaged 1.5 on a scale of 1 to 9 (1 showing lowest effectiveness: force stopped by obstacle—and 9 indicating most effective: force barely slowed by obstacle). While similar data are not available for JRTC, the results probably would show the same trend.

Without sufficient engineer support to the scouts, the following outcomes are the norm:

- The scouts, lacking required engineer support, are either overtasked and/or are unable to provide detailed information on the obstacles.
- Lack of detailed OBSTINTEL means templated obstacles are neither confirmed nor denied, and the TF cannot refine the plan. Thus, the plan and rehearsals are based on a template that may not reflect the current situation. The TF engineer cannot refine the type of breaching technique without information on the type of obstacles.
- When hard intelligence on enemy obstacles and enemy disposition is received by the TF staff, it is often too late to refine the plan or to properly disseminate the information. A planned deliberate attack, in essence, becomes a hasty attack.

Mission 1

In the first deliberate attack, the task force receives the mission to infiltrate and destroy a motorized rifle company (MRC) (-) fortified position NLT 04 0400 Feb 92 in order to pass a heavy TF through the chokepoint.

The brigade order is received by the task force at 01 1600 Feb 92. The TF has 60 hours to plan, prepare, and execute the attack. Prior to receiving the brigade operations order (OPORD), the TF has conducted some initial planning based on the brigade warning order.

The scouts received a warning order from the TF to be prepared to move out on or around 01 2000 Feb 92 for reconnaissance to support the mission. The TF engineer also received a warning order from the TF to be prepared to augment the scouts with engineers for this reconnaissance.

The brigade provided the TF data on the enemy situation: The attacking enemy first echelon motorized rifle regiment had been destroyed. Remnants of the second echelon have transitioned to the defense and are preparing defensive positions. The enemy is defending in sector with a mounted security force forward, guarding obstacles along high speed avenues of approach. The enemy's main defense in sector consists of a series of fortified positions blocking high speed avenues of approach. The enemy has begun digging in and emplacing protective and tactical obstacles. These enemy-fortified positions are believed to be of company-sized strength, consisting of approximately 60 dismounted infantry, three BMPs, and one T-62.

The TF plan is to conduct reconnaissance beginning 01 2000 Feb 92; begin infiltration 03 1800 Feb 92, and execute the attack 04 0400 Feb 92. The focus of the TF staff prior to the scouts moving out is to develop and support the preparation of the recon and surveillance (R&S) plan. In addition to the R&S plan and information requirements, the scouts require a proposed friendly scheme of maneuver in order to understand the intent of the R&S plan.

The TF engineer begins his planning by participating in the intelligence preparation of the battlefield (IPB), and assisting in terrain and threat analysis. The TF engineer adds to the S-2's situation template by templating enemy tactical and protective obstacles.

From this template, the S-2 and TF engineer identify named areas of interest (NAIs) which form the basis for the R&S plan (Figure 1). The S-2 develops intelligence requirements needed to verify his picture of the battlefield. The commander designates intelligence requirements critical to the success of his plan as priority intelligence requirements (PIR). The PIR chosen for this mission are:

- What are the locations of enemy positions and obstacles along proposed infiltration routes?
- What is the disposition of enemy forces on the objective?
- What are the locations and extent of obstacles, mines, and fortifications on the perimeter and within the objective?
- What is the best breach location, with priority, in order, to the northwest, west, south and east?
- Is the assault position a good concealed position?
- Does the support position offer good observation and fields of fire onto the objective?
- What is the disposition of enemy forces surrounding the objective?

The S-2 and TF engineer determine specific obstacle PIR to obtain detailed OBSTINTEL, which includes:

- Obstacle locations
- Obstacle orientation
- Presence of wire
- Presence of boobytraps/early warning devices
- Gaps
- Minefield composition (buried, surface antitank/antipersonnel, and antihandling devices).
- Type of mines
- Location of enemy direct fire weapons

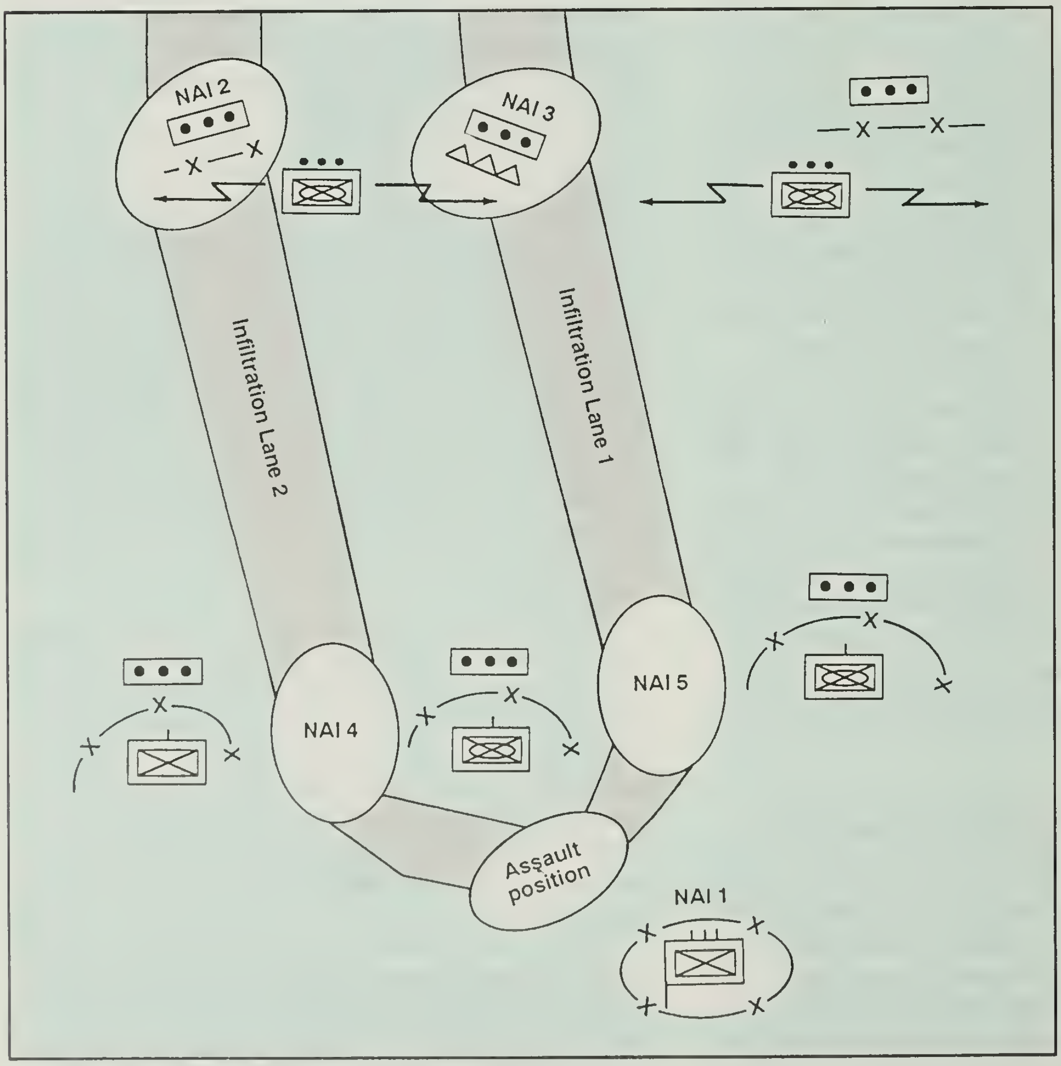


Figure 1

Good OBSTINTEL is important for discovering the type of mines and mine fuzes the enemy has employed. The TF engineer depends on this information to determine which reduction techniques offer the best chance for success and minimal risk to the breach force. A recon team must examine mines within the minefield.

Obtaining OBSTINTEL requires use of all available collection assets: scouts, other maneuver patrols, engineers, aviation, and ground surveillance radars. Engineer expertise (two engineers per obstacle reconnaissance team) or an engineer squad move with the scouts—or patrol—and conduct the detailed recon of the obstacles.

Friendly engineer assets available to the TF include one

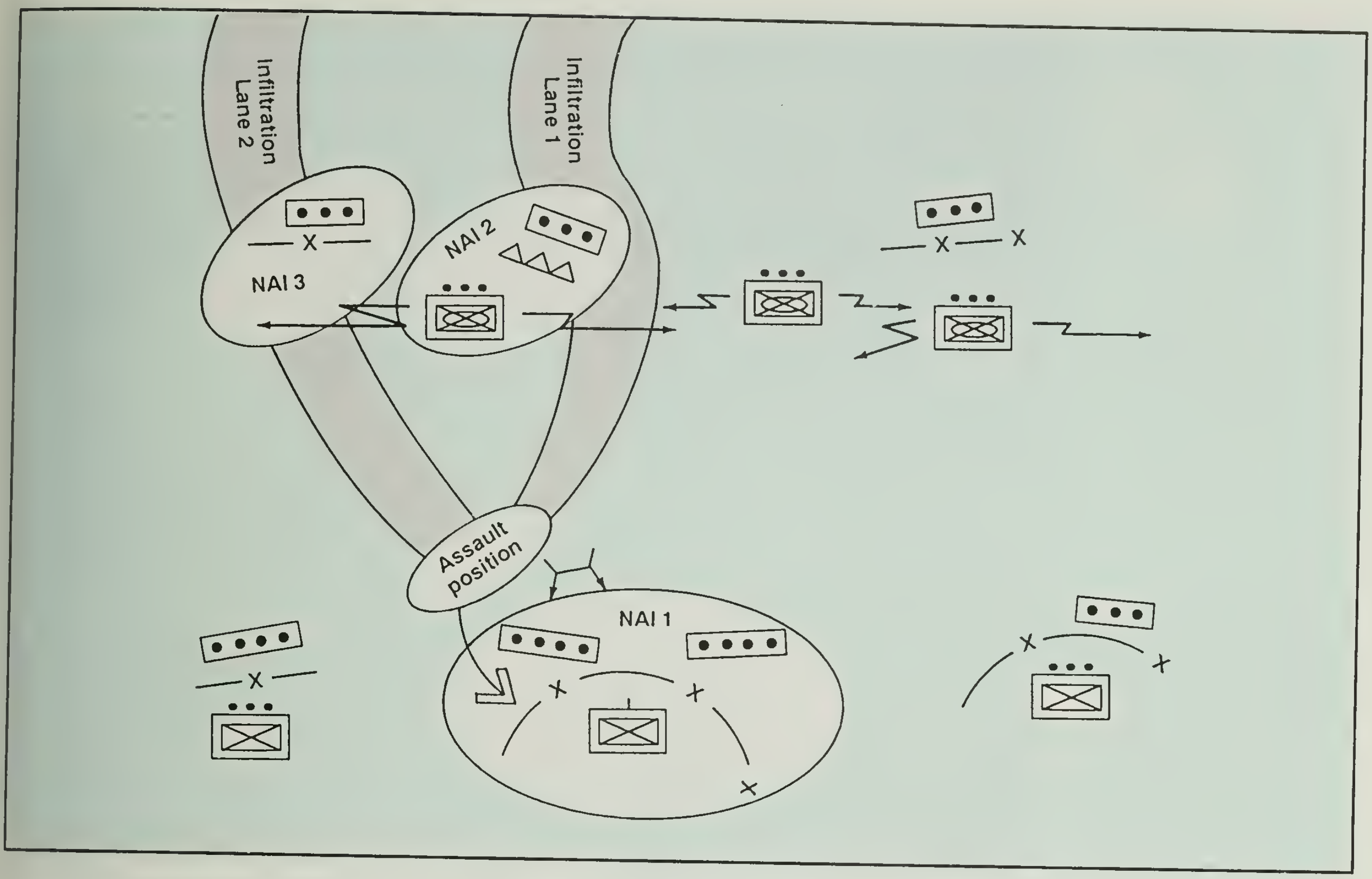


Figure 2

engineer platoon attached to the TF. The TF engineer, after conducting mission analysis, determines that the engineer critical tasks are to:

- Provide engineer support to reconnaissance
- Provide engineer assets to the assault breach
- Breach lanes to pass the heavy force through

The proposed maneuver course of action is for one company to be the breach and assault force, a second company to be a follow-on assault force, and a third company (-) to be the support force. The TF will infiltrate as companies along two infiltration lanes and link up in the assault position.

The TF engineer determines he must:

- Provide support to the breach team to breach two or three footpaths for the assault force
- Be prepared to provide engineers as demolition teams on the objective
- Be prepared to breach one or two lanes for the heavy force

Because the infiltrations will be on restrictive terrain, the TF engineer assumes that instride breaching will not be required. He determines he can attach one engineer team to the scouts and still provide support to the assault.

The S-2 and TF engineer recommend the commander attach one engineer team (four men) to the scout platoon. This engineer team links up with the scouts and conducts planning and rehearsals with the scouts for the mission. The scout platoon leader attaches the engineer team to one of his squads. This scout and engineer squad has the mission to rapidly infiltrate to the objective and begin collecting OBSTINTEL and other PIR on the objective.

The other scout squads will concentrate on NAIs along the infiltration lanes, and find and report bypasses of enemy positions. Later they will assist in the collection of PIR in and around the objective. They wil focus on the timely collection of OBSTINTEL and other PIR on the objective.

Engineers engaged in recon for OBSTINTEL should rarely, if ever, be used to reduce obstacles during recon. This may compromise the recon effort and, thus, the entire attack.

The TF engineer continues his staff planning and engineer estimate. He plans to task organize two squads to the breach/assault force, and one team to the follow-on assault force. He will consolidate his engineers, after destruction of the enemy force, to breach two lanes for the heavy task force.

Detailed OBSTINTEL gained from the recon provides information needed to update IPB products,

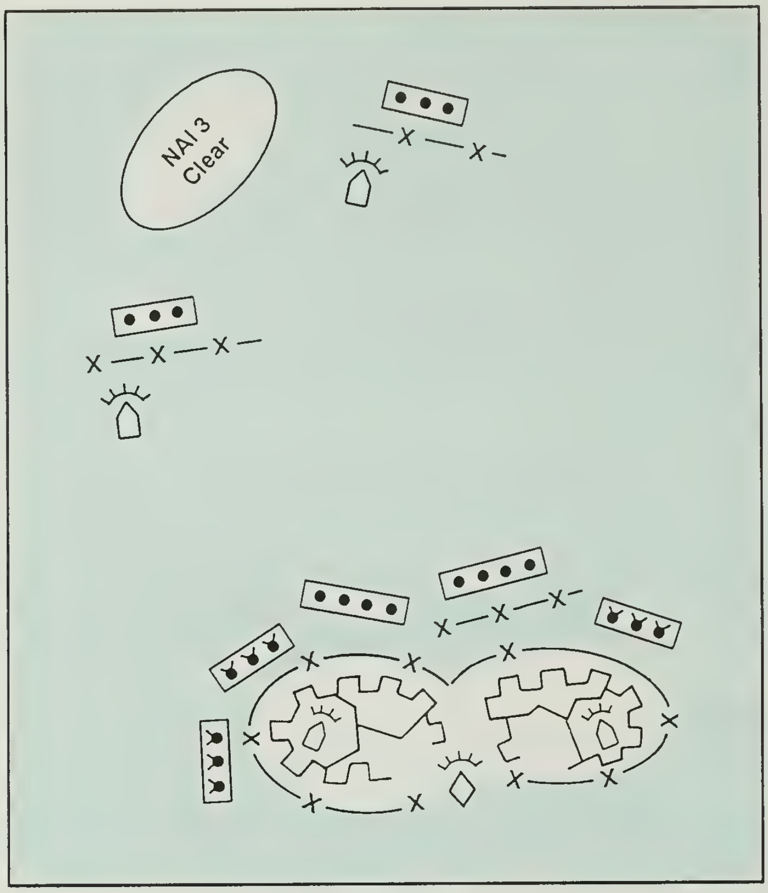


Figure 3

refine the plan, and conduct a rehearsal based on hard intelligence (Figure 2, page 43). Based on this intelligence, the TF engineer can finalize the best breaching technique.

The ultimate success of intelligence collection is determined by:

- Early preparation of the situation template, complete with templated obstacles.
- Preparation of the initial concept of the operation so the recon force understands the scheme of maneuver.
- Developing the R&S plan based on NAIs and PIR.
- Allowing adequate time for reconnaissance.
- Ensuring engineer expertise accompanying the recon gather detailed OBSTINTEL.
- Priority to OBSTINTEL and collection of PIR on the objective.
- Timely reporting of PIR.

Mission 2

The task force received the mission to infiltrate and attack to destroy a regimental CP at 05 0400 Feb 92, and be prepared to conduct follow-on offensive missions. They received the brigade OPORD at 01 1600 Feb 92. Their attack was part of a brigade coordinated attack against a fortified position to pass a heavy force through, along with an attack to destroy the regiment's command and control.

The task force has 84 hours to plan, prepare, and execute the attack. The scout platoon received a TF warning order to be prepared to move out for a recon mission at 01 2200 Feb 92. The TF engineer also received a warning order to be prepared to provide one squad to the scouts for recon.

The TF received an enemy situation similar to the first mission. Additionally, the brigade provided the location of the suspected regimental CP. The CP is supported by one rifle platoon (+).

The brigade commander's guidance is for the task force to infiltrate by platoons through selected passage points beginning 03 1900 Feb 92. The TF plan was to initiate recon beginning 01 2200 Feb 92. The TF would begin infiltration by platoons at 03 1900 Feb 92 along two infiltration lanes, and move to company hide positions by 04 0600 Feb 92. The TF will move again beginning 04 1900 Feb 92 to the assault position and initiate the attack at 05 0400 Feb 92.

The TF engineer begins templating enemy obstacles on the S-2's situational template (Figure 3). Obstacles along the infiltration lanes are expected to be limited, but this must be confirmed by reconnaissance. The TF engineer templates the regimental CP protective obstacles based on a doctrinal template received from brigade.

Templated protective obstacles are limited, and consist primarily of wire boobytraps and early warning devices. Because the protective obstacles will not be extensive and require minimal engineer support, he plans for one engineer squad to support the breach force.

The infantry breach force is capable of providing the majority of the breach teams for this mission. He determines that engineer support to reconnaissance is more critical to mission accomplishment than support to the assault breach. More engineers are required to support recon on long infiltration lanes (14 kilometers for this mission) where the enemy situation and obstacles are unclear.

The need for timely and detailed reconnaissance requires more engineer support for this mission than for the first mission. The TF engineer recommends to the S-2 and TF commander that two engineer squads be provided to the scouts. One squad will support the

The use of engineers with scouts can significantly improve the chances for successful offensive operations. Unfortunately, some task force commanders do not use their engineers for reconnaissance.

scouts along each infiltration lane.

Finding bypasses around enemy positions along these infiltration lanes—and avoiding contact—is critical to the success of the recon and the main body infiltration. It's important for the recon element to move rapidly to the objective to attain timely PIR and OBSTINTEL.

The PIR chosen for this mission are the same as those for the first mission, with the addition of confirming suitable company hide sites and proposed landing zones (LZs).

Engineer teams accompanying the scouts provide OBSTINTEL collection along the infiltration lanes. They bypass obstacles as their first option. Engineers along each lane support covert breaches of obstacles that cannot be bypassed. Surveillance left on these covert breach lanes also act as guides for the main body.

Engineer teams conduct OBSTINTEL collection on obstacles supporting the objective. This recon is conducted 02 1900 to 03 0500 Feb 92, during the hours of darkness, using stealth. Scouts concentrate on enemy disposition in and around the objective and collect other PIR. Engineers who conducted OBSTINTEL on the objective provide guides for the breach force from the assault position to the breach location.

Again, success of the recon depends on timely development of an R&S plan, adequate time for recon, engineer expertise to recon, and timely reporting.

Conclusion

Without engineer and other collection asset support to OBSTINTEL collection, the scouts are limited by time and expertise in providing detailed information on enemy obstacles. Only through effective use of engineers can a commander expect his recon force to provide an accurate picture of the battlefield.

Engineers are well trained for dismounted patrolling and reconnaissance. It's essential that TF recon training include their supporting engineers—and that engineers consistently train with the scouts. The reward of this integration is development of an effective combined arms reconnaissance team. Field Manual 90-13-1, *Combined Arms Breaching Operations*, contains an excellent discussion on this subject that is applicable to both light and heavy forces.

Captain Kula is attending Command and General Staff College. He was previously assigned to the Tactics, Training and Doctrine Division of the Engineer School's Department of Instruction. He served as the senior engineer observer/controller at JRTC from 1987-1989. He is a graduate of West Point and the Infantry Officers Advanced Course.

Address by

Lieutenant General François Bresson

"Inspecteur du Genie"*

To Students at the U.S. Army Engineer School

My dear engineer friends, it is a pleasure and an honor for me to meet you today. First, because as engineers we share common features. In our missions, in our techniques, and in the way we work and we serve. Second, because between the French and Americans there are more than two centuries of friendship, during which time our two nations never confronted each other but were always in the same camp, the one of freedom. Lastly, because anyone who has 36 years of service like I do takes a lot of interest in speaking with young sappers still at the beginning of their careers.

Before beginning, I must tell you that last year Major General Schroeder (former commandant of the U.S. Army Engineer School) took a rather bad initiative: he gave his lecture in French. Therefore, you should complain to him for listening to me in English now. I hope that despite my pronunciation, you can still recognize the language I am using!

I also bear a grudge towards General Schroeder for another reason: he said everything about Putnam and Vauban that there is to be said!

Therefore, I decided instead to tell you about the Franco-American cooperation in 1917 to 1918, and about the role taken by a great engineer, Marshall Joffre. Then, I will present to you the different components of the French engineers and their prospects for the future.

Lastly, I would like to tell you the guidance I give to engineer officers to help them in their commands.

Exactly three quarters of a century ago, on April 24, 1917, the French cruiser Lorraine arrived at Hampton Roads, Virginia. On board was Marshall Joseph Joffre. He was welcomed by the admiral commanding the American Atlantic Fleet. President Wilson sent him his personal yacht, the Mayflower. It was on board the Mayflower that Joffre sailed up the Potomac River and arrived in Washington on the 25th of April.

How was Joffre welcomed?

How were the Franco-American agreements developed, and on which points did they focus?

What lessons can an engineer draw from Joffre's personality?

These are the three topics I

*** General Bresson holds a position in the French Army similar to the Chief of Engineers.**

French river crossing training on a Rhine site.

would like to address in order to recount this historical event.

Joffre's welcome from the highest authorities and from the American people is summarized by this quote n a New York newspaper: *"Today, the nation salutes France through the person of Joffre. Just as Lafayette once symbolized France for millions of Americans, so does Joffre symbolize France for millions of Americans today. God save America."*

Much ceremony surrounded Joffre's visit to the White House and to the State Department. He was also received at the War College by General Kuhn and the chief of staff, General Scott. He visited the Engineer School, then located at Washington Barracks. There he said, "I feel at home!" Congress gave him a standing ovation and asked him for "just a word." He raised his hat at arm's length and said "I don't speak English. Long live the United States."

He did a passing review of West Point cadets, he visited Mount Vernon and meditated in Washington's room, in front of the three swords with the inscription: *"These swords will not be drawn to shed blood, except for the defense of the country and of its freedom."* Lastly, in New York, Mayor Mitchell welcomed him with these words: "You are a man from the people, and by degrees, you have reached the highest military honors."

In short, this month-long welcome expressed the Franco-American friendship and the generosity and dynamics of the United States.

As far as the Franco-American agreements are concerned, two things are significant. The first is the extraordinary mood of confidence and sympathy that marked the talks. Marshall Joffre was received in the afternoon-long tete-a-tete by President Wilson, and he met many times with Secretary of State Baker, General Scott and General Kuhn. The most difficult questions about organization, command, accommodation, training, and so on, were solved in the highest community of thinking.

These decisions are the subject of a simple memorandum. As proof of outstanding mutual confidence between the two nations, it was agreed that the memo would be implemented without an official signature.

And that is what really happened, for less than three weeks later, the First Infantry Division embarked for France. Heading these first elements was the famous General Pershing. President Wilson solicited the advice of Marshall Joffre in selecting General Pershing.

Joffre's action on the general philosophy of these agreements was key. When it was recognized that the United States would enter into the war, the British staff and part of the French staff wanted to recruit small units of American volunteers who would be scattered within allied units in order to reinforce them. But Joffre was convinced this would be a mistake. He knew that one must not set up an army of mercenaries who would fight under a flag other than their own.

He said one must set up a grand American army, for a grand people fights well only under its own flag, commanded by its own leaders and organized according to its own methods.

This is a lesson we must not forget. And this is why on November 11, 1918, at the end of the war, more than 800,000 Americans were in the trenches and more than 1,500,000 were ready to fight under General Pershing's orders, and under the folds of the star spangled banner.

As for Joffre's personality, there are several things for us engineers to remember. Like Putnam and Vauban, he was from quite modest origins. His father made barrels and sold wine in the south of France (a good French job!).

His qualifications were thorough and varied. He attended the Ecole Polytechnique, but he also knew Tonkin, Taiwan, Sudan and Madagascar, during times when these countries were hostile environments. He was also "in the field" a lot, this being normal for an engineer.

He mastered all the techniques of our branch, particularly fortification and building railroads—so important at this time. His main quality was serenity, based on confidence, skillfulness, and a rational examination of all situations.

The following anecdote illustrates Joffre's serenity. It was during the very difficult period of late August 1914. One of Joffre's main subordinates came to the general in his CP to tell him some important news. Joffre asked him: "Won't you stay and have lunch with us?"

"Yes, sir, but before I would like..." the general stopped him.

"Very well, we have veal. Do you like veal?"

"Sir, I've got important news to..."

"Do you like veal?"

"Yes, Sir."

"Well, we will speak about the rest after lunch."

Recognize that Marshall Joffre, when he arrived in the United States, had just been relieved of his command. Joffre, a man who never weakened during the most difficult moments of those first 28 months of war; Joffre, the victor of the battle of the Marne. But he disagreed with the government on the conduct of operations. And in this case, as is the rule in a democracy, it is the military chief who quits. This story can happen again nowadays.

It is my pleasure to remind you that Joffre, an engineer general officer, was chief of the French armies (at the time, 4,000,000 soldiers) from August 1914 to December 1916. From this, each of us can conclude that all hopes for a career are within ourselves.

I would now like to speak to you about the French engineers of today. Their responsibilities and strengths are certainly different from American engineers, but this does not prevent us from sharing numerous points in common.

First, how are the French engineers structured? Basically, there are five types of organizations. The first type of organization is the civil engineers. Their expertise covers the whole military infrastructure (except harbors and some air force bases). The central directorate is located in Paris: Lieutenant General Delorme has his office right above mine and we work together often. The civil engineers' district covers not only the whole national territory in Europe, but also overseas as well, in the West Indes, Guyana, Reunion Island, New Calendonia and in Polynesia (Tahiti and Nururoa atoll).

There is a central design bureau in Paris; officers and civilian employees are trained in the engineer service school in Versailles, or in civilian engineer schools. The operating budget is roughly $1 million.

The second organization is the adapted military service battalions that exist only overseas. They have the twofold mission of giving draftees a professional education and carrying out national assistance programs.

The third organization is comprised of the battalions devoted to civilian security missions. They are designed to protect the civilian population against the hazards of warfare and, in peacetime, from natural or technological disasters. They are always on alert and are able to deploy an emergency rescue detachment to anywhere in the world within a few hours. One such unit is the Paris firefighter brigade. This brigade also fulfills a number of very specific missions, such as the technological security in the Kourou space center in Guyana.

The fourth organization is comprised of the battalions specializing in lines of communication. By this, I mean the rapid repair of roads or airstrips attacked by the enemy. We also have a minimal railroad works capability. During peacetime, the battalions train by constructing army training camps and doing infrastructure work for air force bases, which saves us money. In past years, they were assigned missions in Chad and Benin,and soon they will deploy to Cambodia.

The final organization is the combat battalion at corps and division levels. They have a modular structure. That is, we strive to restrict the types of companies to four:

- Combat companies, designed for breaching and countermine operations.
- Forward bridging companies, able to provide forward river-crossing equipment for both dry and wet gaps.
- Countermobility companies, designed for creating barriers and mining.
- Heavy bridging companies, equipped with PFM (looks like your ribbon bridge).

The structures are identical, but the equipment varies depending on whether the division is armor, wheeled, or airborne.

What are the main concerns of the French engineers today? First, to succeed in reducing our Army by 20 percent, from 285,000 to 225,000 soldiers, by 1996 or 1997. The engineers represent 12 to 13 percent of this total. We want to minimize the impact of this downsizing on the people concerned.

Second, to thoroughly modernize our basic training to produce effective soldiers that serve only 10 months. Draftees constitute half our strength. We think that this is possible with some conditions that I will explain ater if you wish.

Third, to draw all the lessons earned from the new state of the world, and more specifically from the Gulf War. We must implement these lessons within a budgetary context that is not very optimistic.

For the engineers, and more generally for the French Army, we tress the following points. In any peration that includes a projection of force, the first detachment must have an engineer reconnaissance party.

This engineer NCO uses an international hand signal that we all can understand.

Afterwards, it will be converted into an engineer command, for we think that any combined arms chief must have next to him the commander of the engineer unit that supports him. This is always the key in order for the engineers to be properly employed. Moreover, it is the engineer who has to propose to his commander the part of the operation order that concerns engineers.

The engineer assets devoted to facilitate deployment and logistics for the force must deploy first, something our infantry and armor friends tend to forget. Within this echelon, we must find sufficient assets for heavy roadworks, something we did not do during the Gulf War. It might be said that the conditions of our previous commitment in Europe have given us bad habits!

Moreover, we have to satisfy two deficiencies. On the one hand, if we have very skillful and highly trained mine clearers, we lack heavy mine-clearing equipment, maybe because we are looking for the "perfect" asset which doesn't exist.

We are emplacing in each armored combat company assets similar to your expectations for a MICLIC-like machine, on which no decision has been made yet. We work intensively on infrared cameras, whose future seems interesting to us, especially for spotting minefields and perhaps for locating individual mines and for clearing mines.

On the other hand, like you, we think about the threat of scatterable mines and submunitions. We have initiated a vast training endeavor in this field, but so far we have not found a good solution for either equipment or for the distribution of missions between engineers and other branches. Should we give to units from another branch the capabilities to get out from mined or "polluted" areas?

Before ending this second part, I would like to speak to you about one more important dilemma for the future of engineers that may also exist in your country: Our strength is decreasing, and at the same time, the diversity of our possible commitments is increasing. Actually, we see that the areas where the French Army could be committed in force are no longer limited to Western Europe. They now cover the whole of Europe and many other regions, some of which have different climates and far less developed civilian infrastructures.

At the same time, combat mobility is increasing and engineers must be able to act within the whole operational theater, for example, for mineclearing or "de-pollution."

And finally, the diversity of missions is increasing also, with the larger probability of peacekeeping or humanitarian actions. It is the reason why we are going to have to continue to cultivate engineers to be multi-talented, which seems difficult to me, at least for soldiers and especially for officers and NCOs. Like General Schroeder said last year, "It is better to have skillful soldiers for mine-clearing operations, but at the same time, it is hazardous to commit a combat company to plumbing!"

Yes, of course, but it will be necessary for our cadre and especially our line officers to know how to do both. That is not new, but we are going to have to wonder again in the years to come, is it better to take an officer and then make him an engineer, or to take an engineer and train him as an officer? We have to think about that for our schools.

In my third and final point, I am going to tell you about the way to command. Of course, I know that only experience is the best teacher. As far as I am concerned, I owe a lot to the jeep driver my first captain gave me in 1959 in Algeria. He had a reputation for being a bad soldier and he had just been punished for having struck his sergeant. This was not very encouraging for a young lieutenant like myself.

I decided to intentionally forget his bad past, and he appeared to be an excellent soldier then, courageous and devoted. This first experience has comforted me in the idea that any man is able to improve himself, if he is trusted. And this certainly made a bigger impression on me than my commanders' long speeches.

Nevertheless, it is useful to study the advice given by our seniors. I often recommend that young engineer officers read this little book. It was written in 1831 by an officer who had begun his career under Napoleon. Unfortunately, he has a failing: he was a cavalryman. But, after all, engineers are, like infantry and cavalry, a branch of direct contact with the enemy—as we say, "a melee branch."

This small book has a strange format, exactly the dimensions of an explosive petard from that time. As a matter of fact, it was an enormous success. During the 19th century, the French light cavalrymen used to have an explosive petard on each side of their saddle inside their "legs." But their officers carried a petard on the left side and this book on the right side.

This book has a lot of very valuable advice. On education, it reads: "Let the officer get ready, let him educate himself, let him search his job in the smallest details; one cannot command that which one ignores. The chief who imagines that he hides his weaknesses from the soldiers is silly—the soldier knows him better than he knows himself, let him use his time to correct his weaknesses, not to hide them."

This book reads too: "...the officer must not wear his overcoat when the soldier has not been given the order to put it on nor warm himself inside a house that is off limits to the soldiers."

And this last advice which we have to modify in our day, of course, "In the field, at the bivouac, the officer must make sure that horses eat (i.e. to refuel), that damaged saddlery be fixed (to do maintenance), that weapons are sheltered, and there are no quarrels between soldiers, and so on..."

You may have noticed two things from these few examples of the experiences of senior leaders. On the one hand, moral qualities become actual behavior in every day life. On the other hand, much of this advice remains true 150 years after being written, for technique and equipment change, but man changes little.

Some other principles are very useful today. I want to quote two of them. At the head of a unit, platoon or company, leaders succeed one another every two or three years. We must be mindful to progress in the continuity, which requires unselfishness. Your problem is not to be better than your predecessor, but to work so that your successor might be better than you.

Besides, relations between men must be our essential concern. Surely there are differences between you, who work with volunteers, and us, who have a good proportion of draftees. But either way, a soldier needs his leader to listen to him and needs his leader to speak to him. This is not always easy for a young officer who sometimes has to command men who are older than he is. The truth is that in peacetime everyday life, we may forget that we are made to fight together, that we are "fellow soldiers." The military men have an enemy—life in the barracks, and a friend—life in the field.

Finally, there is one peculiar concern for an engineer leader. Placed next to a higher-level combined arms chief, the sapper must always begin with a good understanding of the goal sought by this chief. For example, the engineer captain must be thinking at the level of the infantry battalion commander he is supporting.

If he is able to do that, he will nake good recommendations for he employment of his company, nd eventually he will be sure to et orders suited for engineers. 'he engineer will not dwell on the errain difficulties or delays as the ngineers are often reproached vith!

In conclusion, the main quality f the sapper is certainly courage nd the will to succeed. You know his, and you know how to say it vithin a single French word: "Essayons." Isn't it too, by itself, a nagnificent testimony of the riendship which links us?

Thank you very much. It has een my honor and pleasure to peak to you today!

(Personal Viewpoint Continued)

combat operations. (These operations were insignificant in the sense that they did not put our men and machines under the gun—so to speak.) In the Gulf War, all countermine operations were conducted against undefended or very lightly defended minefields.

My concern is that we fought the shadow of an enemy in Kuwait, yet we tend to picture the Persian Gulf ground war as a tremendous military success. This picture threatens to mask the issue of our inadequate countermine capability and, if left uncorrected, may rob our Army of its ability to conduct offensive operations.

Today's Opportunity

Engineers must not join with members of the military community who use the victory in the Persian Gulf to spotlight limited success while hiding abject failures. Rather than allowing the success of Desert Storm to hide our capability needs, engineers should use this war to illustrate that combat engineer systems development has not kept pace with that of other combat systems.

TRADOC's establishment of six Battle Labs may further degrade our ability to maintain a suitable level of countermine priority in the Army. TRADOC headquarters strongly support the Battle Labs and has tasked all schools and centers to support their development. It appears the Battle Labs will become TRADOC's focal point for all high-technology systems combat developments. All the attention given to these labs, if coupled with a weak countermine strategy, will almost guarantee that the Army will once again ignore the need for countermine capabilities.

This issue is especially important as TRADOC brings the mission of the Battle Labs into focus. That mission, in my opinion, may inadvertently focus much of TRADOC combat developments toward the interests of the Battle Labs' host branches. Therefore, engineers must take immediate steps to influence Battle Lab development while they are still in the embryonic stage. We must ensure that the labs receive strong, dynamic engineer input for countermine and other engineer initiatives.

Engineers must ensure that, within the Battle Labs, there is an understanding that the Gulf War was an anomaly, and that the probability of our next conflict being like Desert Storm is very low. The Persian Gulf victory and the loss of a Soviet threat in Europe does not mean we are entering a period with no mine threats. If anything, these events should be viewed as harbingers of escalating global destabilization, where antagonists will capitalize on the warfighting contribution and economics of land mine usage.

While we cannot foresee what the future will bring, we can set into motion events which may influence the future. Engineers at all levels must work to ensure that engineer military art, and the resultant force, keep pace with the ever-changing face of the battlefield. It is our responsibility to push for "leap ahead" changes in technology. We must demand that our doctrine, tactics, techniques, and procedures evolve in such a way that they capitalize on future capabilities and do not languish in the bowels of the "old Army." Above all, we must push for new canvases of technology on which we can design countermine war machines for tomorrow's conflicts. Essayons! while the door of opportunity is open.

Dr. Sickler is the Science and Technology Advisor for the Technology Division, Directorate of Combat Developments, at the Engineer School.

ENGINEER UPDATE

Commercial numbers are (314) 563-XXXX and Defense System Network (DSN) numbers are 676-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

Defense System Network (DSN) Lines Eliminated. When calling the Engineer Hotline or Engineer School personnel, callers must leave a commercial telephone number (not Autovon or DSN). Effective 1 September 1992, Engineer School personnel can dial only commercial numbers; outgoing Autovon/DSN lines have been eliminated. POC is MSG Nick Payton -7528.

Repair Parts for Place Training Mine (PTM) Kits. Repair parts for PTM Kits are being produced at the Army Training and Support Center, Fort Eustis, VA. The repair parts allow units to initiate action to make inoperable PTM kits serviceable. Parts may be ordered through local Training Aids Support Centers (TASC). POC is CPT Bart Ives, -7805.

DA PAM 350-38, STRAC Revisions. DA Pam 350-38, dated 24 September 1990, remains in effect until 1 October 1993. The revised DA Pam 350-38 (dated 1 October 1992) is scheduled for distribution in December 1992 but will be used ONLY for planning purposes until the strategy becomes effective on 1 October 1993. Major revisions for individual and crew qualifications are:

- *Active Component:* Five inert MICLICs.(3-inch rockets) for combat companies at home station, two live MICLICs for each company rotating to the National Training Center (NTC). CEV qualification converts from the 165mm TP round to the M970 device (with 40mm round). TP and M970 are both authorized during a CALFEX. No night qualifications are required.
- *Reserve Components:* One inert MICLIC per company every two years. CEV qualification converts to the M970. TP and M970 are both authorized during the LTX. No night qualifications are required. Minimal demolition increases are planned to support collective training. POC is Rayburn Toy, -7784.

Training Films. Two new training films are available through your local Training Aids Support Center (TASC):

TVT 5-28A, *The Small Emplacement Excavator (SEE), Familiarization and Initial Inspection Procedures*, 28 minutes. Film identifies major components and controls, illustrates operational checks, and demonstrates initial inspection procedures.

TVT 5-29, *The High Mobility Material Handler (HMMH), Familiarization and Initial Inspection Procedures*, 28 minutes. Film identifies major components and controls, and demonstrates inspection procedures for the forklift assembly and other parts. POC is Dave Shafer, -7749.

Directorate of Combat Developments (DCD)

Digital Topographic Support System (DTSS). A total of 22 DTSS are scheduled for distribution to Active division, and echelons above corps units. Low rate initial production of seven DTSS will begin in January 1992, with fielding scheduled for 4th quarter, FY 93. The remaining 15 systems will be fielded by FY 97. Planned enhancements to the basic DTSS include terrain visualization, increased processing capabilities, multispectral imagery exploitation capability, and downsizing to support light divisions. POC is SFC Paul Lake, -7327.

M9 Armored Combat Earthmover (M9 ACE) Improvements. A systems improvement plan for the M9 ACE will increase effectiveness and operational readiness. Modifications include a ripper blade with a blade uplock kit, strengthened roadarms, improvements to filters and hoses, a bolt-on front track retainer (Florida plate), and steel skid plates. The National Training Center's Blue Force vehicles will be modified first (1st quarter FY 93) so rotating units can try the enhancements. Some modifications will be in kits applied at the organization level. Others will be applied by the contractor or depot personnel concurrent with a modification to the microclimate cooling system. Additional improvements will be introduced to the supply system as they become available through attrition. POC is SSG Rothstein, -7974.

Modernized Demolition Initiators (MDI). A nonelectric initiation system under evaluation is expected to replace detonating cord and time fuzes, making blasting machines and continuity testers obsolete. The MDI will be used to initiate all demolition items in FM 5-250, *Explosives and Demolitions*. They will be used by engineers, infantry, cavalry, special forces, and explosive ordnance disposal soldiers. Human factor evaluations will be conducted in November 1992, with full testing planned for FY 93. The MDI may be fielded as early as FY 94. POC is SFC Burgess Ewing, -7337.

Engineer Branch Safety Office (EBSO)

Explosives and Demolitions Accidents. Three engineer soldiers have suffered serious accidents on explosives and demolitions ranges in the past 12 months. One soldier died as a result of injuries, and two other were seriously maimed. Contributing factors to these accidents were improperly trained and certified range personnel, non-compliance with minimum safe distance requirements, and not performing to standards. Standards for using explosives and demolitions are in AR 385-63 and FM 5-250, *Explosives and Demolitions*. POC is Paul Rusinko, -5002.

Directorate of Evaluation and Standardization (DOES)

New Director Welcomed. DOES welcomed LTC Joseph P. Maher, their new director, in August. LTC Maher, who previously served as a project manager with the U.S. Transportation Command at Scott Air Force Base, may be reached at -5270.

Total Engineer Force Readiness. Input from engineer units is requested to support a study to determine total engineer force readiness in terms of personnel, equipment, and training. The Engineer School is gathering data from recent unit status reports (USR). To participate, engineer units should forward copies of their latest USR cover letter and DA Form 2406 through their major command headquarters to Commandant, US Army Engineer School, Attn: ATSE-ESA, Fort Leonard Wood, MO 65473. POC is Vern Lowrey, -5304.

Engineer Personnel Proponency Office (EPPO)

Female Opportunities. A decision was made in April to open all positions in corps bridge units except CMF 12 to females. The determination on CMF 12 positions depends on the outcome of the CMF 12 consolidation study. Because the proposed consolidation will drastically affect the configuration of CMF12, that decision was delayed until all phases and issues of the consolidation are resolved. POC is Cynthia Mathews, -6341.

Reserve Component (RC)

Engineer Officer Advanced Course-Reserve Component (EOAC-RC). The new EOAC-RC will consist of Phase I, Correspondence, and Phase II, Resident. Officers must be at least a first lieutenant to enroll and will have two years from the date of enrollment to complete the work. The new course is designed so that knowledge gained during the correspondence phase will be reinforced by practical exercises conducted in the resident phase.

Enrollment for Phase I (Correspondence) of the new course will begin in January 1993. Phase I, which contains 208 hours of correspondence studies, will be a prerequisite for attendance at Phase II.

Training for the new Phase II (Resident) EOAC-RC will begin in January 1994. Phase II will be two weeks of resident training at the Engineer School.

The Army Correspondence Course Program (ACCP) catalog, DA PAM 351-20, and Army Training Requirements and Resources System (ATRRS) will be updated to reflect the new course requirements.

POC are COL Colcol (USAR), -6336, or LTC Juneau (ARNG), -7742.

Assault River Crossing in Normandy

By Dr. James W. Dunn

Army engineers played a major role in the advance of American forces out of the Normandy beachhead area in July 1944. The 105th Engineer Combat battalion supported the 30th Infantry Division assault across the Vire River on 7 July. A successful river crossing was crucial to the drive toward St. Lo and the eventual breakout.

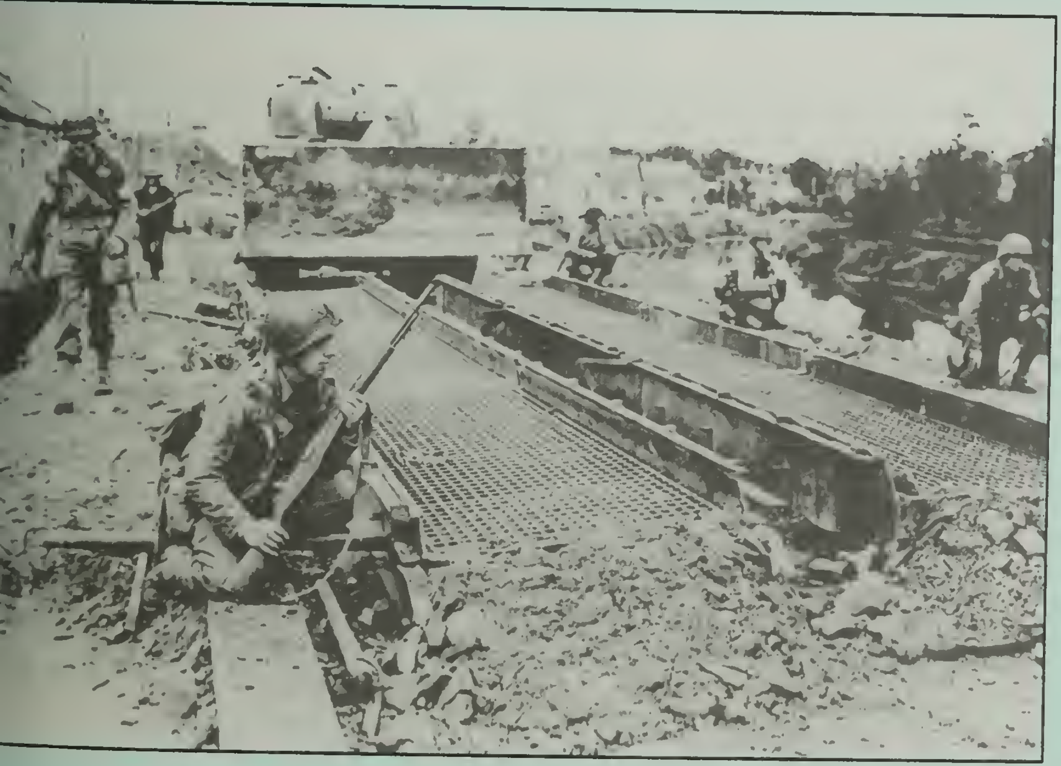
Preparing to attack, the 30th Division deployed with its right along the north bank of the Vire Et Taute Canal, its left on the east bank of the Vire River, and its center near the village of Airel, where the canal and river met. The 60-foot wide river was 9 to 14 feet deep and had steep banks while the shallow, 20-foot wide canal had gently sloping banks and a muddy bottom.

On the other side of this water obstacle, German strength included elements of an SS Panzer Division and an infantry division. The Germans were well rested and occupied ground that rose gradually toward the south, giving them good observation and fields of fire.

To attack this strong defensive position, the 30th Division had considerable support, including dive-bomber strikes and eight battalions of corps artillery. The 1104th Engineer Combat Group, a corps unit that had the 246th and 247th Engineer Combat Battalions, the 992d Engineer Treadway Bridge Company, and the 503d Engineer Light Ponton Company supported the division's 105th Engineers.

The division planned to use this force in a two-regimental, converging attack toward St. Jean-de-Daye, which was 3 miles equidistant from the river and the canal. The 117th Infantry Regiment's attack across the river at dawn on 7 July was to precede the 120th Infantry Regiment's attack across the canal by about 8 hours.

The 105th commander, LTC Carroll H. Dunn, assigned C Company to assist the 120th Infantry across the canal. They were to build a footbridge, provide scaling ladders for



Stone Bridge at Airel

the first assault wave, and help the corps engineers install a treadway bridge. He assigned A Company to support the 117th Infantry's effort across the river. They were to build scaling ladders for the first wave, provide infantry assault boats for the first three waves, help the corps engineers construct a ponton infantry support bridge and a floating treadway bridge, and repair the stone bridge at Airel. He ordered B Company to assist A Company with the assault boat crossing and to build a foot-bridge across the river.

Prior to the attack, the engineers crossed infantry patrols to the far shore, reconnoitered potential bridge sites, and cleared approach paths through hedgerows and minefields. They rehearsed the assault boat river crossing, practiced bridge construction, and prepared footbridge and treadway bridge sections. While practicing hedgerow tactics, they found that two 15-pound TNT charges in burlap bags opened a gap large enough for a tank.

By 0300 on 7 July, all preparations were made and everyone was ready when A Company and a platoon from B Company, 105th Engineers, met the 117th Infantrymen at the line of departure. Rain and bad weather had grounded their air support, including artillery spotter planes, and made the riverbanks muddy and slippery. Carrying rubber assault boats and scaling ladders, the soldiers moved to the riverbank and started across at 0430. The first wave of 32 boats, each carrying three engineers and 12 infantrymen, met resistance from only a single German machine gun. But as engineers on the near shore pulled the rope-attached boats back, artillery and mortar shells began to fall. The second and third waves paddled through heavy German fire to cross successfully.

As the assault waves crossed, engineers in LT. Gilbert Ray's 3D Platoon, B Company, began to install the footbridge. They had six bays in the water when a direct hit killed four men and wounded four others. Seeing the bridge builders in trouble, Sergeant Oliver Pointer's squad from A Company came forward to help emplace the bridge. The last bay was just in when artillery rounds tore the bridge loose from its moorings and inflicted additional casualties. Swimming into the river, engineers secured the bridge and had it ready by 0530. The 3d Platoon lost 50 percent of its strength and gained a distinguished unit citation in this action.

By 0700, the corps engineers in support of the 105th Engineers were in action, working first on the partially destroyed stone bridge at Airel. As artillery rounds continued to fall, the 247th Engineers cleared mines and filled holes while a platoon from the 992d Engineers brought up treadway sections on Brockway trucks. Suffering heavy casualties, the engineers emplaced the treadway sections and had the stone bridge ready for a bulldozer to cross by 0900.

Meanwhile, the 503d Engineers began to install the ponton infantry support bridge at 0730. They had it ready by 0830, but at a cost of 15 casualties. At the same time, A Company, 247th Engineers, while under heavy artillery fire, began to install a floating treadway bridge just south of the stone bridge. It was ready at 1130, at a cost of 4 killed and 7 wounded. Thus, by noon, the engineers had repaired one bridge and installed three others at the river.

Germans had flooded the canal, causing it to be wider and deeper than expected. The infantrymen hesitated to wade across at 1330, waiting instead for the engineers to install a duckboard footbridge. After some confusion, the infantry started to wade across at 1345 and within 35 minutes the 1st and 3d Platoons, C Company, 105th Engineers, had the footbridge in place for the heavy weapons companies. The 2d Platoon accompanied the 120th Infantry across the canal to clear the roads and aid the advance toward St. Jean-de-Daye. The 3d Platoon crossed to gap the hedgerows for the following armor units.

To accommodate the tanks, A Company, 246th Engineers, had treadway bridge sections loaded on Brockway trucks waiting in the rear for some halt in the German artillery fire. Ordered to disregard the artillery fire and erect the bridge, the 246th engineers, assisted by the 992d Engineers, began to install the treadway sections as division artillery fired smoke rounds. Within 20 minutes the bridge was ready for tanks to cross.

That night the 30th Infantry Division's converging attacks met to establish a continuous line near St. Jean-de-Daye. The 105th Engineer support for river assault was successful, and the drive to St. Lo could continue. While there was much hard fighting ahead, the first critical steps toward a breakout from the Normandy beachhead had been taken.

Additional Reading:

Beck, Alfred M., *The Corps of Engineers: The War Against Germany,* U.S. Government Printing Office, 1988.

Blumenson, Martin, *Breakout and Pursuit,* U.S. Government Printing Office, 1961.

Dr. James Dunn is chief, Studies and Analysis Division, Office of History, U.S. Army Corps of Engineers, Fort Belvoir, Virginia.

BRIDGE THE GAP

By Command Sergeant Major Richard N. Wilson
U.S. Army Engineer School

“The American soldier is a proud one and he demands professional competence in his leaders. In battle, he wants to know that the job is going to be done right, with no unnecessary casualties. The noncommissioned officer wearing the chevron is supposed to be the best soldier in the platoon, and he is supposed to know how to perform all the duties expected of him. The American soldier expects his sergeant to be able to teach him how to do his job. And he expects even more from his officers.”

General Omar N. Bradley

The requirements for Army leaders and their soldiers’ expectations, as identified by General Bradley during World War II, are still valid today. The question “What do my soldiers have the right o expect from me?” is complex and difficult to answer. Our soldiers do have some very valid expectations and rights that we leaders must fulfill.

As noncommissioned officers (NCO), we have always believed that “accomplishing the mission” and the “welfare of our men” were our principal esponsibilities. Those responsibilities will not hange in the future. If we are to accomplish a mis- ion, no matter what it is, we must focus our ac- ons on maintaining the welfare of the soldiers we erve.

First, our soldiers have the right to live and work n a disciplined environment. Many soldiers join the rmy looking for and expecting discipline: They want an environment where confidence is instilled hrough tough training, where good performance is cknowledged and rewarded, and where leaders stablish and enforce standards and hold all sol- ers to those standards.

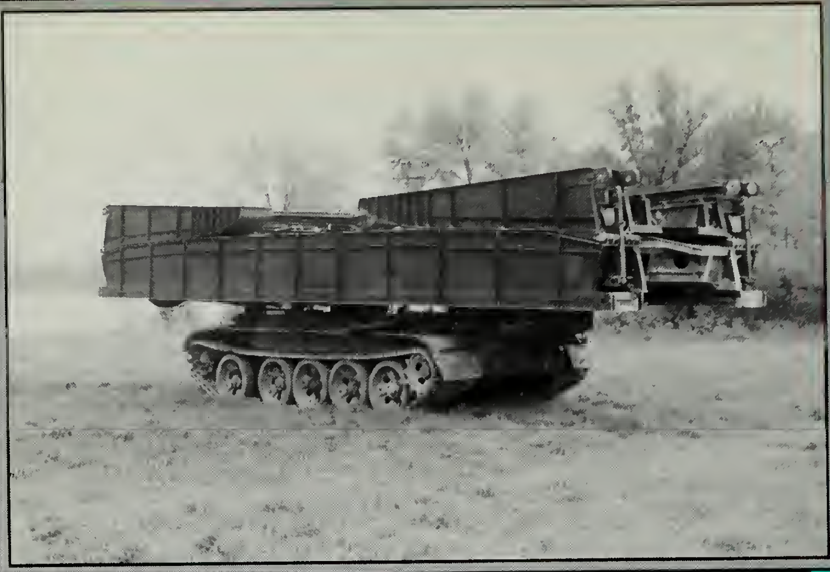
Our soldiers have the right to serve in units where leaders protect them from harassment. They expect, and deserve, to serve in units where treatment is fair and equal for all. It is totally unacceptable for any leader to tolerate any type of discrimination toward a soldier or to provide only lip service to the philosophy of equal treatment.

Our soldiers also have the right to expect first-class training that is conducted in a safe environment. They expect the training they receive and the equipment they train on to be the very best that we can provide. All NCO leaders must plan for, rehearse, and execute a quality of training that provides the edge needed for survival on the battlefield. That training must be tough and demanding, and support the commander’s mission essential task list (METL).

As engineer leaders, we must also support our institutional training bases. First, we must continue to adequately prepare our soldiers for participation in Noncommissioned Officer Education System (NCOES) and functional courses. Then we must select the best qualified NCOs for career development at our schools.

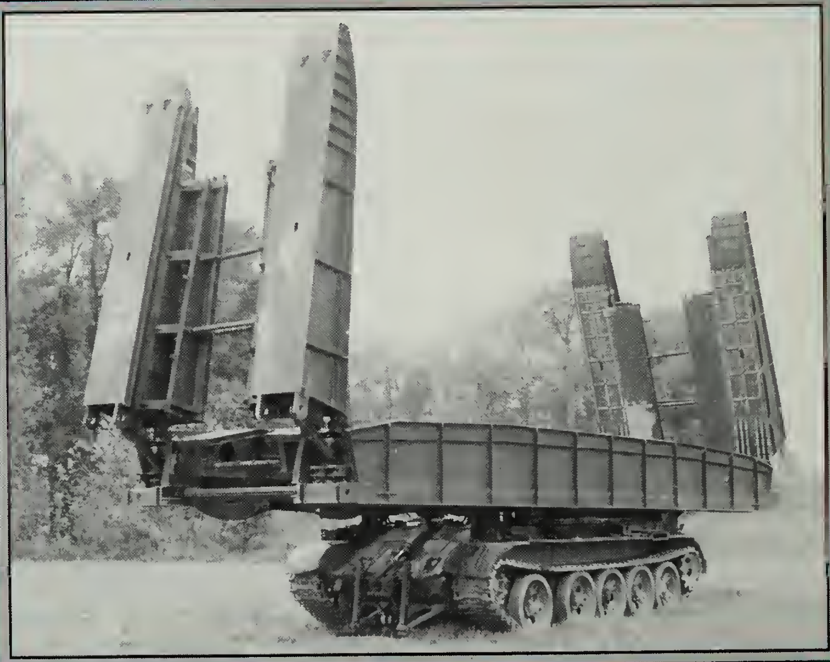
Quality of life has become a priority for our Army. NCO leaders must make that our priority if we expect to keep the quality of soldiers the Army needs. We must work to improve the environment in which our soldiers live, work, and train. All of us must strive to upgrade billets and housing; develop active, effective sponsorship programs; and demonstrate genuine concern for everything that affects our soldiers’ lives.

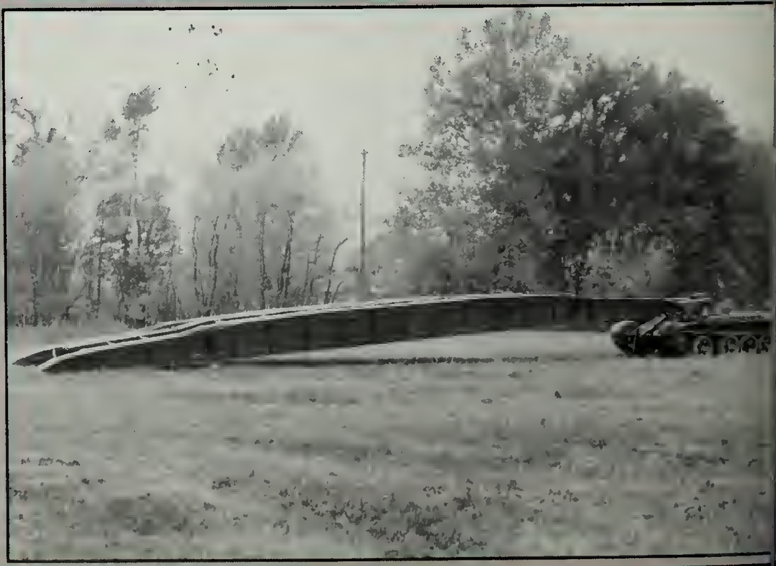
Above all, soldiers have the right to expect their leaders to live by the Army’s personal values and professional ethics: loyalty, duty, selfless service, and integrity. A leader who lives by these values will totally fulfill his soldiers’ expectations.



MTU-20
Armor Vehicle Launched Bridge

Weight with bridge: 37,000 kg (40.7 tons)
Maximum gap width: 18 meters (59 feet)
Bridge weight limit: 60,000 kg (40.7 tons)
Crew: two





The MTU-20 AVLB is a modification of the T-55 Medium Tank. A chain drive mechanism and a front mounted stabilizer have been added for launching the bridge.

When the bridge is launched, the stabilizer blade is emplaced, the bridge end ramps are unfolded hydraulically, and a chain drive mechanism moves the bridge forward.

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ENGINEERING

Engineer

THE PROFESSIONAL BULLETIN FOR ARMY ENGINEERS

Department of the Army

February 1993

Responding to Hurricane Andrew

Engineer Restructure Initiative

Functional Area Assessment

PB 5-93-1

Approved for public release; distribution is unlimited.

CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

Interesting times! When you read this, we will have undergone our first Presidential political party transition in 12 years. However, we must not lose sight of the fact that the fundamentals of our national military strategy will not change during this process. A summary of some military objectives that will not change include the following:

- Provide robust power projection capabilities to promote deterrence and stability
- Maintain forward presence forces abroad
- Conduct peacekeeping, humanitarian assistance, disaster relief, and other "restoration" operations
- Develop and provide strong nation assistance or security assistance capabilities
- Participate in Army domestic missions designed to contribute to the nation's moral and social fabric
- Provide forces that are capable of conducting continuous operations across the entire operational continuum

These objectives will shape the future operations of our Army as the international environment continues to evolve. Our Army, and especially the Corps of Engineers, must be poised and ready to perform its missions in virtually any theater under any conditions. More specifically, we must continue to maintain our vast combat capabilities while increasing our ability to respond to contingency missions in operations other than war. Not easy to do in a period of decreasing resources. This will be our greatest challenge in the foreseeable future!

To meet this challenge, we engineers must continue to be a dynamic and diverse arm of the greatest Army the U.S. has ever seen. We must continue to exploit and refine our unique capabilities to provide assistance in operations other than war, and to better position our Army for the 21st century. This issue of *ENGINEER* describes some of the diverse capabilities of our Corps, from expert sapper skills to Hurricane Andrew responses. The Corps' response to Hurricane Andrew in Florida and Louisiana and Hurricane Iniki in Hawaii typifies the broad scope of engineer missions. Lessons learned from the disaster-relief operations are in an article beginning on page 26.

The human challenge in Somalia is another example of our Corps' diverse missions. Colonel Bob Flowers, the joint task force engineer for this operation, has built a team consisting of six personnel from the Engineer School. In addition to providing engineer command and control, they are assessing the needs for infrastructure improvements and will provide valuable information to the Engineer Corps on future requirements for this mission area. Also, Mr. Vern Lowrey, of our Directorate of Evaluation and Standardization, was deployed to Somalia in January with the Center for Army Lessons Learned team. His assignment is an example of our commitment to the "Total Army" concept that is so vital in an era of shrinking resources. More on this important mission will appear in future issues of *ENGINEER*.

Humanitarian relief missions and nation assistance are not new to engineers. Our chief of staff has in fact described them as "traditional" Army missions. However, they are becoming increasingly complex: they broaden our perspective, challenge our creativity, and provide our nation and our Army with opportunities to foster conditions for peace and peacetime competition.

Really looking forward to further developing some of these thoughts with you during the Senior Engineer Leaders Training Conference 93 (SELTC 93), which will be held here at the Engineer Center on 20-24 April. This year's theme is "Decisive Victory." Key speakers will discuss topics such as "Engineer Roles in the Attainment of National Objectives," "Crisis Response: Forced Entry Operations," "Crisis Response: Decisive Operations," and "Preserving Peace in America's Largest Theater." Additionally, breakout working sessions will tackle current issues related to heavy and light divisions, corps mechanized and wheeled divisions, combat heavy and topographic units, and engineer roles in disaster relief, including some emerging lessons learned.

As you can see, there is a varied and demanding agenda for the fifth annual SELTC. Look forward to seeing many of you here at Fort Leonard Wood as we continue to prepare our Army and our Corps for the challenges expected in the 21st century. Essayons!

Engineer

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Cover: *SGT Brian Coderre of "C" Battery, 116th Field Artillery Army National Guard, Palmetto, Florida, provided security for outside perimeter of the Florida City Park Distribution Point. (U.S. Army Photo by SGT Zedrick G. Rockett)*

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DEPARTMENTS

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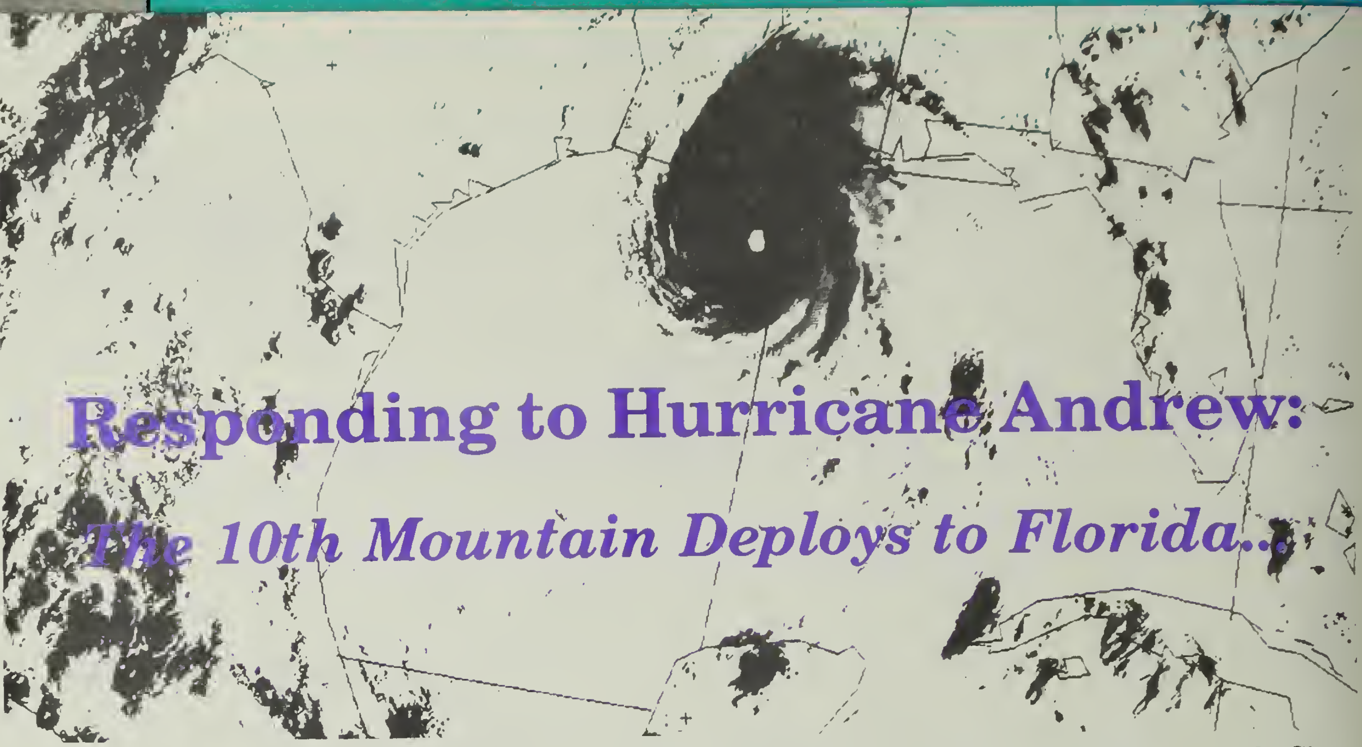
Responding to Hurricane Andrew:

The 10th Mountain Deploys to Florida...



Hurricane Andrew devastated south Florida on August 24, 1992. Hardest hit were Homestead, Florida City, and other communities in south Dade County. By request of Florida's governor and approval of President Bush, federal troops, active and reserve, were sent to Florida to assist in the cleanup operation. The 10th Mountain Division and the 43rd Engineer Battalion assisted in this mission.

Three days after Hurricane Andrew ravaged the Florida mainland south of Miami, the XVIII Airborne Corps sent a "be-prepared" mission to the 10th Mountain Division, Fort Drum, New York. The 10th would deploy to south Florida to assist in the hurricane relief operations. With sketchy details and some assumptions, the 10th began mission analysis and planning.

Leading problems included how large of a force to deploy, how to tailor the engineer assets, and what kinds of equipment and how much of each type to send.

On the evening of August 30, the 10th Mountain received their deployment order: leaders would go first to analyze the situation and provide guidance for the division's deployment. Along with the order were deployment specifics that addressed time lines, staging areas, and sorties—but little information about the ground mission. Therefore, the same problems (kinds of equipment and amount of each) existed, so they relied on their engineer battalion's initial planning. As a minimum, the 10th decided to take chain saws, small emplacement excavators (SEEs), bucket loaders, dump trucks, carpenter and pioneer tools, and sappers and equipment operators trained to use the equipment.

The Engineer Battlefield

When the 10th arrived in Florida, the soldiers' initial reaction to the hurricane's devastation was awe. What they had seen in newspapers or on television was nothing compared with the actual destruction in Homestead, Florida City, and other parts of south Dade County. Homestead Air Force Base was hit head-on; the only thing left undamaged was the runway.

Trees were toppled everywhere, utility lines and traffic lights were down, mobile-home parks were flattened, and debris was everywhere. Portions of roofs in many housing areas were ripped off, exposing interiors to the elements; water damage was extensive. Gale-force winds, upward of 180 miles per hour, had ripped glass from every building. As a result, there were mountains of debris, traffic gridlocks, utility outages, and general crisis and fear throughout the devastated area. For a castlebearer, it was an engineer battlefield.

The 841st Engineer Battalion, Florida Army Reserve, was the first engineer force on the ground in the Task Force Mountain sector. They were tasked to clear debris in Florida City, a rural agricultural community south of Homestead. Their initial efforts were to clear trees, fencing, house debris, and telephone poles from roadways and thoroughfares.

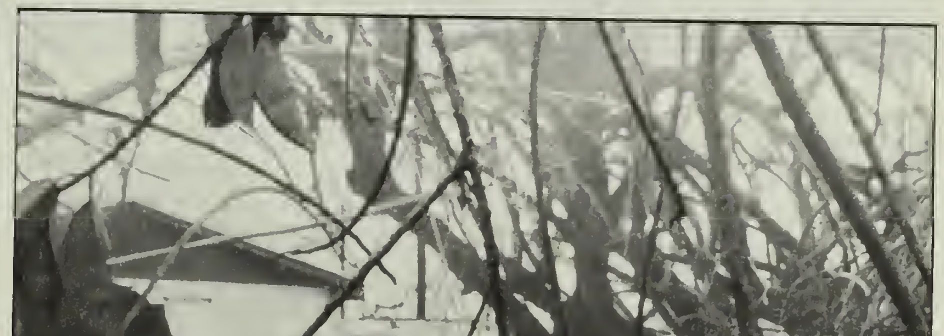
Equipment operators from the 43rd Engineer Battalion, Fort Benning, supported the 841st. A brigade-sized task force from the 82nd Airborne Division, Fort Bragg, was located north of the Task Force Mountain sector and was supported by the 27th Engineer Battalion, Fort Bragg. The 20th Engineer Brigade, Fort

By Lieutenant Colonel Peter Madsen and Major Wayne Whiteman

Bragg, provided general support to the Corps area of operations.

The equipment needed to clean up the debris and keep all the engineers ready to deploy from Fort Drum working was not available. To solve this problem, the 10th Mountain Division enlisted help from the Joint Task Force Engineer; Commander, 20th Engineer Brigade; and Jacksonville District Commander, Corps of Engineers to contract for commercial bucket loaders and dump trucks. They initially requested 50 bucket loaders and 200 dump trucks for the entire corps sector because no one knew how far the engineers would have to haul the debris.

Three days later, corps contracts brought the initial equipment package of two loaders and en trucks into the Task Force Mountain sector. The next day an additional 15 bucket loaders and 75 dump trucks arrived. Using the commercial equipment, Task Force Mountain peronnel began to organize the debris clearance mission. Together, infantry, artillery, and ngineer units brought debris to he roadside, helped fill bucket oaders and dump trucks, and leared the areas. The combined



Top: The magnitude of the devastation from Hurricane Andrew challenged relief efforts.

Bottom: Cutting through the debris was a major task for engineers.

Military and civilian contracted engineer equipment hauls debris from public rights-of-way to dump sites.

arms teams used commercial equipment to clean up debris while organic equipment was being flown in. An unexpected source of support came from many volunteer organizations and municipalities in Florida and other southeastern states. These groups sent bucket loaders, dump trucks, and cherry pickers to augment equipment in the Homestead Department of Public Works.

Organizing for Success

With the equipment on-site, the 10th Mountain Division assigned work sectors to the 1st and 2nd Brigades, the aviation brigade, and the division artillery, with an engineer company attached to each unit. This plan of action had several positive results: each brigade was responsible for all relief activities within its sector; the 10th Mountain Division leaders and Florida City, Homestead, and south Dade County officials interacted to keep on top of the cleanup operations; brigade commanders assigned work priorities; and brigade engineers advised the maneuver commanders of these priorities.

The top priority was to remove debris from areas that affected sanitation or impeded rights of way. After debris removal in these critical areas was under control, the engineer focus shifted to constructing relief camps and food distribution sites (tent cities), assisting public utility crews, and clearing debris from parks and recreation areas.

The 937th Group constructed two relief camps with 700 and 1,200 person capacities, respectively. Each camp had shower and laundry facilities, administration centers, and dining areas. Utility engineers installed the electrical, water, and sewage systems in the camps. The 586th Engineer Company, with 45 bridge trucks, transported humanitarian supplies to the camps. Restoring school grounds then became a joint effort. Army troops cleared the exterior grounds; Navy Seabees and Marines repaired roofs and interiors. As a result of this joint effort, more than 90 percent of the damaged schools opened by September 14th.

Task Force Mountain succeeded for several reasons, one of which was the integration of echelons above corps (EAC) engineer units. In early September, FORSCOM alerted and deployed several engineer forces into the theater. The XVIII Airborne Corps placed the 937th Engineer Group OPCON to the 10th Division. The 937th served as the command and control headquarters for the 43rd Engineer Battalion, the 63rd Engineer Company, the 586th Engineer Company, and the 841st Engineer Battalion. The 41st Engineer Battalion remained organic to the 10th Mountain Division, with most of its assets attached to brigades in several sectors. Their assets included sappers, chain saws, SEEs, and dump trucks.

The EAC units meshed quickly because the 41st Engineer Battalion's engineer operations section controlled the engineer forces. The commander of the 41st served as the division engineer, while the commander of the 937th Group served as the senior engineer commander to Task Force Mountain. With this arrangement, integrating EAC forces was transparent at the division level and differences in reporting and standard operating procedures were resolved within engineer channels.

The critical nature of the relief effort did not allow for normal staff integration procedures. The EAC had to respond quickly with what they had available to provide immediate relief to the hurricane victims.

Other organizations contributed to the success of the disaster relief effort. The Corps of Engineers, Jacksonville District, augmented with volunteers throughout the Army Corps of Engineers, contracted for ice, potable water, dumpsters, portable toilets, roof covering, trailers for schools, fencing, and utility services. Six large private companies opened burn sites throughout the sector so military and civilian units could haul debris into them. The Federal Emergency Management Agency (FEMA) contracted for clearing mobile-home parks and hooking up utilities to temporary trailers, which became semipermanent homes to displaced families living in relief camps.

Members of the 202d Red Horse Engineer Squadron, as part of the joint relief effort, load a log onto an articulating front loader. (Photo by TSGT Rose Reynolds, USAF.)

Finishing the Mission

Task Force Mountain's participation in the Hurricane Andrew relief operations was a success. Initially, however, they were not well synchronized with he Corps of Engineers. To solve hat problem, USACE liaisons oordinated with the 10th Moun-ain Division and local municipal and county governments to focus efforts on the immediate needs of ommunities hit by the hur-icane. Commercially contracted ngineer equipment allowed roops to start cleanup opera-ions within days after the disaster. Brigade engineers in each sector defined their missions and assigned priorities based on need. Aggressive, close coordination with civic organizations, volunteers, FEMA, and the Corps of Engineers allowed divisional engineers to voice their concerns and needed actions. The results were quick relief from the crisis and a clear path toward recovery. Military troop units redeployed, and by early October, FEMA and USACE were the main agencies involved in the continuing relief operations.

Even though disaster relief is not a commonly trained mission, it did not differ much from a wartime situation. Mission analysis at the home station, early assessment in sector, and synchronization of key assets allowed 10th Mountain Division engineers to exert their expertise on a different kind of battlefield. They responded quickly and efficiently to this time-sensitive mission and were effective throughout the entire operation. Their responsive and constructive efforts truly benefited the citizens of south Florida.

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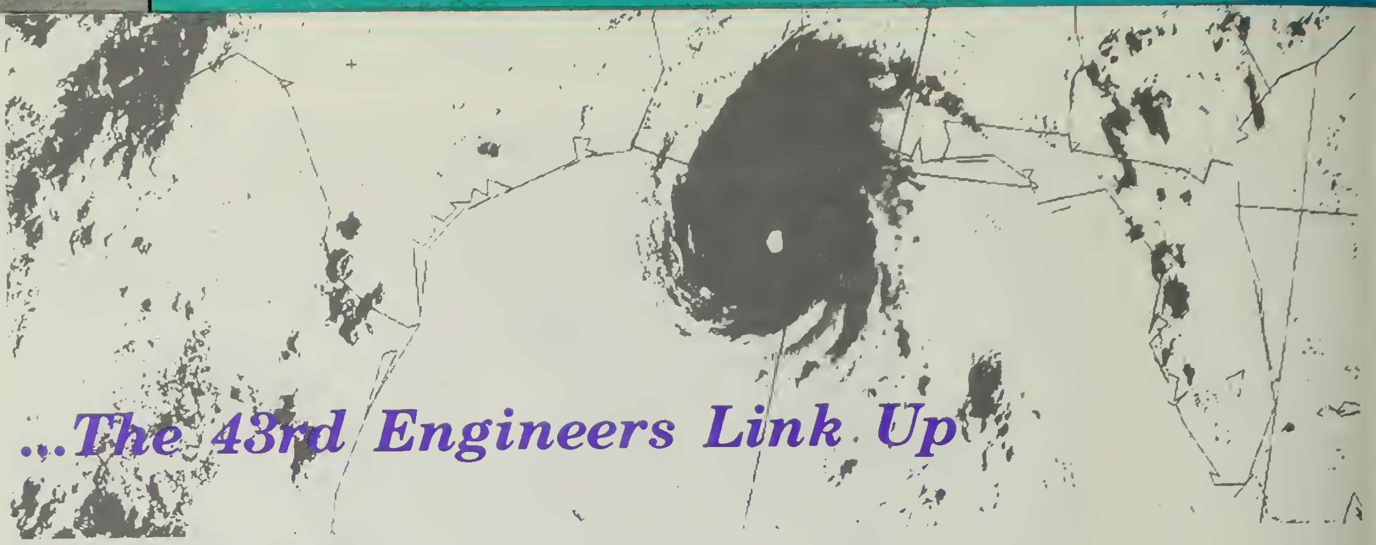
Major Wayne Whiteman is the S3 of the 41st Engineer Battalion. Previous assignments include assistant professor of civil and mechanical engineering at West Point, company commander for the 2nd Engineer Battalion, and S4 for the 76th Engineer Battalion. He is a graduate of West Point and CGSC and holds a masters degree in civil engineering from the Massachusetts Institute of Technology.



...The 43rd Engineers Link Up

The 43rd Engineers, Fort Benning, Georgia, returned from a field exercise the day before Hurricane Andrew struck. Staff members immediately stopped work on the field exercise recovery operations and prepared three contingency plans in response to the disaster, based on guidance from higher headquarters:

- Send 200 soldiers, mainly heavy equipment operators and equipment, to clear debris. Keep support to the absolute minimum.
- Deploy the entire battalion with organic equipment and the 63rd combat Support Equipment (CSE) Company attached.
- Send 200 soldiers without equipment. Soldiers would use equipment from the 841st Engineer Battalion, a U.S. Army Reserve Corps combat engineer battalion headquartered in Miami.

About one week later, the 43rd received an execution order to send 200 soldiers to replace the volunteers of the 841st Engineer Battalion, who needed to return to their civilian jobs. On August 31, 200 soldiers departed Fort Benning by commercial bus. They joined their reserve counterparts who were cleaning up debris in the hard-hit Florida City area. "The event was historic, if for nothing else, it emphasized the total Army concept," said Lieutenant Colonel Robert L. Davis, Commander, 43rd Engineer Battalion. "It was the first time that I know of where an Active unit fell in beside and operated the equipment of a Reserve Component unit."

Because of the scope of the disaster, the advance party determined that the entire 43rd Engineer Battalion, with the 63rd CSE Company attached, needed to deploy. The 43rd's rear detachment arranged for commercial bus transportation,

By Major Allen C. Estes and First Lieutenant Alex Lucas

The 43rd uses a bucket loader to scoop up the enormous amount of debris left by Hurricane Andrew.

commercial line haul for the heavy equipment, and convoy clearance for 127 vehicles on the 730-mile road march.

When the 43rd and 63rd arrived in Florida, they were assigned to work in the sector operated by the 10th Mountain Division. Their initial assignment was to clear the enormous piles of debris that lined the streets. Soldiers went from house to house picking up everything in sight. "The rules were not to go in any further than 10 feet from the curb," stated Captain Troy Wilson, Commander, 63rd CSE Company. "But if someone asked for help or obviously couldn't do it themselves, we didn't hesitate to lend a hand." The equipment and squads were divided into teams of loaders, dump trucks, rented wood chippers, and chain saws. With this action plan, the soldiers cleared entire streets in a matter of hours. The soldiers had to handle the debris piles with extra caution because they contained everything from trash and construction material to hypodermic needles and dead animals. Downed power lines were another hazard because some of those presumed dead carried electricity from homes operating off generator power.

The 43rd engineers hauled more than 4,000 oads of debris and put about 3,500 miles on each dump truck. While local city and county agencies dentified the dump sites, changing conditions complicated the situation. One day the dump would be closed; the next day a special pass was required to use it; and sometimes the soldiers had to separate he loads into burnable and nonburnable material. Such confusion delayed progress, and eventually the 43rd was tasked to help run the dump. Trucks were lined up five or six deep waiting to dump their loads, and burning operations ran concurrent with dumping.

Within two weeks, the Corps of Engineers had contracted with so many civilian agencies that the military contribution to the total haul effort dwindled. The 43rd then reoriented its primary effort to constructing tent cities at the Campbell (120 tents) and the Homestead Middle Schools (78 tents). The relief sites were designed to provide temporary shelter for people who had lost their homes. Typically, two families shared a standard Army GP medium tent.

Initially, the 43rd was tasked only to build tent floors and provide electricity, but they also built shower units, constructed a parking lot, installed security lights, and built a large stage. The relief camps provided excellent training opportunities in plumbing, electrical, carpentry, and equipment operator skills for the soldiers of the 43rd. Material acquisition was simplified through unit Class A agents and a Homestead city contract with a local hardware store and electrical supplier.

The 43rd's base camp at Homestead Bayfront Park was one of the few sites large enough to store all the equipment in a combat heavy engineer battalion. The soldiers lived in tents, and mobile kitchen trailers were consolidated to create a battalion-sized dining facility. The park had running water so plumbers quickly built make-shift showers. The battalion ran a complete maintenance operation, including third shop support for both

Engineers set up GP medium tents as temporary shelters for hurricane victims in South Florida.

engineer and ordnance equipment.

While work hours extended from sunrise to sunset, the battalion eventually rotated platoons one day off each week. With the hectic work schedule and the uncertainty about how long they would remain in Florida, morale, welfare, and recreation became an important issue. The chaplain conducted religious services and arranged for a folk concert in the base camp. The Miami Hurricanes and Miami Dolphins both donated tickets for football games, and the Corps and division set up rest and relaxation areas. The 43rd's base camp had a volleyball court, games, television, and a lagoon for swimming. (The lagoon was not the most popular spot after one soldier pulled out a 3-foot barracuda.)

About one month after their arrival, the 43rd had completed their mission and prepared to redeploy to Fort Benning. The 43rd Engineer Battalion and the 63rd CSE Company returned to Fort Benning on September 25 with the pride and knowledge that they had responded superbly in time of need

LESSONS LEARNED. *Additional lessons regarding disaster assistance missions are in the Lessons Learned feature beginning on page 26.*

Issue: If disaster relief will be an engineer mission, the Engineer School should predesign some tent-city base camps and create a package similar to the Army Functional Component System (AFCS).

Discussion: Because engineers construct temporary camps in crisis situations only periodically, they are not fully trained for the task. Predesigned camps would help units respond quickly in a disaster relief effort. If relief camp construction is to become a common mission for combat heavy battalions, the Engineer School should provide the 51R electricians, who specialize in interior wiring, training in exterior power distribution.

Issue: Class A agents and accounts with local vendors are essential.

Discussion: To construct relief camps quickly, a unit needs immediate access to materials. The 43rd Engineer Battalion deployed with two ordering officers and three Class A agents. Homestead city helped establish accounts with a local hardware store and an electrical supplier for obtaining materials. These vendors were able to acquire materials from anywhere in the greater Miami area.

Major Allen C. Estes is the Battalion S3 for the 43rd Engineer Battalion, Fort Benning, Georgia. A West Point graduate, he has two masters degrees in civil engineering from Stanford University. He is a registered professional engineer in Virginia. MAJ Estes previosly served with the 36th Engineer Group headquarters and the 249th Engineer Battalion and taught in the Engineer School and Department of Mechanics at West Point.

First Lieutenant Alex Lucas is the battalion civil engineer for the 43rd Engineer Battalion. He is a graduate of the Airborne and Pathfinder courses. 1LT Lucas has served as platoon leader of a vertical and earthmoving platoon and as company executive officer.

Terminate the CEV — Now!

By Colonel J. B. O'Neill

I think it's time to refuel the debate on terminating the combat engineer vehicle (CEV). There is no question that the CEV is a maintenance and readiness albatross. One need only glance at the monthly DA readiness averages to see that it is consistently below standard. However, the issues to debate revolve around the necessity for the CEV on the battlefield and the replacement for the CEV (the M1 Breacher). Here is my bottom line up-front—"Gong" the CEV now!

The Problem

This is not a new debate. In fact, the Army decision to replace the CEV with the M1 Breacher appears complete, and it should be fielded this decade. Nor is the notion of getting rid of the CEV new. Not long ago, General Saint, the former Commander in Chief, U.S. Army Europe (CINC, USAREUR), recommended removing all CEVs from Europe. General Saint's position was based on the vehicle's documented record of excessive downtime, combined with an assessment that the missions performed by the CEV could be performed by other combat vehicles and systems organic to heavy divisions. Antitank ditches don't have to be breached solely with the CEV moldboard (blade); AVLBs also can perform that task.

Additionally, the CEV's demolition gun is extremely limited in range and accuracy. General Saint concluded that demolition targets could be engaged by the M1 tank. The M1's accuracy is a quantum improvement over the CEV's accuracy, although the M1 high-explosive antitank (HEAT) round's destructive effect is less than that of the CEV's 165mm high-explosive plastic (HEP) round. Comparable destructive effect can be provided simply by firing more HEAT on the target. In sum, the CINC, USAREUR concluded that an M1 can take out fortifications too! Therefore, the CEV is not mission essential.

Many heavy divisions now enjoy a full complement of M9 ACEs. They make a big difference in our obstacle-breaching capability. When the CEV was the only hardened earthmover in the force, it was clearly appreciated as a readiness "pacing item." The CEV's age and low density have historically combined to keep that pacing item's readiness rating below standard, often at a C4 rating (not ready). All that has changed.

The M9 ACE is now the engineers' premier protected earthmover for breaching operations. Thus, a C4 readiness status for the CEV no longer renders the entire engineer battalion C4 in overall mission capability. In fact, some units now equipped with the M9 ACE subjectively upgrade readiness when CEVs are down, and some are pursuing an exemption to the pacing item reporting requirements for CEVs.

The Solution

Pending acquisition of the M1 Breacher, I recommend that the Army replace the CEVs with M1 tanks equipped with plows. By making this interim adjustment, we will replace an unreliable vehicle with a reliable one equipped with a plow blade. The greater gun accuracy achieved with the M1 will also improve our ability to engage standoff demo targets. We may even justify production of an M1 HEP round for "bunker-busting" type missions. An M1 tank equipped with a plow provides the engineer force with a common, readily supportable chassis today—not years from now.

This solution will allow us to begin resolving crucial combat system documentation issues well ahead of the M1 Breacher's fielding. For example, we probably can determine the optimum number and type of required maintenance personnel. We can resolve operator and gunnery issues, prescribed load list/authorized stockage list (PLL/ASL) issues, etc. At the same time, table of organization and equipment (TOE) personnel spaces for the M1 Breacher will remain validated.

(Continued on page 16)

FAA

Functional Area Assessment Resolves Engineer Issues

By Colonel Wyland Leadbetter

> ***"The focus...was modified to concentrate on restructuring the Army while maintaining total force readiness during a period of unprecedented change and turmoil."***

The Army constantly undergoes change. The current effort to reduce the size of the Army in response to the collapse of the Soviet Union has forced significant changes in the total engineer force structure in the Active and Reserve Components. Changes in a large bureaucratic organization can be challenging, and those projected for the Army over the next few years will significantly affect many aspects of the military engineer structure. The magnitude of these changes requires specific oversights at all Army levels to ensure that they are accomplished with minimum disruption to the units involved.

To help manage changes at the Department of the Army (DA) level, the Vice Chief of Staff of the Army (VCSA) initiated the functional area assessment (FAA) process in 1983. The process provided a means for the Army to identify and resolve issues that precluded or inhibited the execution of short-term plans and programs. The intent was that through issue resolution, the Army, organized by functional areas in a stovepipe structure, would be forced to solve problems through horizontal integration.

The FAA's focus was on specific program objective memorandum (POM) years and units that would be affected most by the programmed

Objectives

- Accomplish the restructuring effort with minimum adverse impact on:
  - The soldier
  - Readiness
  - Modernization by force package
  - Personnel, training, and leadership development
  - Materiel redistribution
  - Doctrine
  - Total force integration
- Resolve issues at the lowest level that may inhibit restructuring effort.

changes. The goal was to ensure that all factors relevant to organizational development and materiel acquisition and fielding were integrated into the force with minimal impact on readiness. Ideally, each Army functional area was to conduct an FAA every two years.

The Engineer FAA

The first engineer FAA, in 1984, was an intense review of the total engineer functional areas, specifically structure, doctrine, training, personnel, and materiel. Issues in these areas were discussed thoroughly and resolved at the lowest possible level. Issues that could not be resolved went to the VCSA for resolution. While conducting the first FAA, the process of horizontal integration between all Army members, including major Army commands (MACOMs), proponent schools, units, and agencies that provided solutions to issues that had been unresolved for years, seemed to work. The impact was felt throughout the Army; the FAA process was here to stay.

The second engineer FAA, in 1987, also resolved ssues successfully. During the Persian Gulf War, the process was suspended but not forgotten. In October 1991, the VCSA reaffirmed the Army's commitment to he FAA process. The focus, however, was modified o concentrate on restructuring the Army while mainaining total force readiness during a period of unprecedented change and turmoil. The purpose of the process was refined to look at the impacts of restrucuring on specific functional areas throughout the POM years. It would be used to promote a well-coordinated, comprehensive, and cost-effective transition to a smaller force, while maintaining emphasis on warfighting readiness, maximizing combat power, and accomplishing force modernization.

The 1992 FAA

In June 1992, the Engineer School was informed that an engineer FAA was scheduled for presentation to the VSCA in October. The school's Systems Priority Integration Division (SPID), Directorate of Combat Developments (DCD) was tasked to lead the effort. A world-wide message to all MACOMs, Army agencies, and engineer units announced the FAA and requested issues for consideration.

An FAA team, consisting of one colonel, two NCOs, and a DA civilian, was established within SPID and committed full time to the project. Major General Christman, Engineer School Commandant, provided guidance to better focus their efforts. He identified equipment that needed immediate attention and requested that the team be sensitive to the mix of Active and Reserve Components and fully integrate both into the FAA process. MG Christman believed that a new mind set was required to focus attention on the national strategy for crisis response, including force projection, forced entry, national assistance, and disaster relief.

Issues were forwarded to SPID throughout June and July. The team catalogued each issue and assigned a point of contact (POC) at the Engineer School. The POCs reviewed each issue and resolved problems at the lowest possible level. Issues were catalogued according to TRADOC's

Purpose

- Examine the impact of restructuring the Army through the POM years on the engineer functional area
- Ensure well-coordinated, comprehensive, and cost-effective transition to a smaller force focusing on...
  - Maintaining wartime readiness
  - Maximizing combat power
  - Selective force modernization
  - Soldier welfare

Concept-Based Requirements System (CBRS) modernization functions: doctrine, training, leader development, organization, and materiel (DTLOM). An issue was considered resolved when the initiator and the school's POC concurred with the solution. A steering committee at the Engineer School reviewed the team's work and provided guidance throughout the process. Periodically, a general officer in-process review (IPR) was conducted to ensure that the FAA process was in line with MG Christman's intent.

By mid-August, 120 issues had been identified, and 105 of them had been resolved at the Engineer School. The remaining 15 were approved by the Commandant for presentation to the VCSA.

The review process, however, was not complete. During September and October, TRADOC and the Combined Arms Center commanders, a council of colonels and a general officers steering committee at DA, and the Deputy Chief of Staff for Operations and Plans (DCSOPS) reviewed the 15 issues. After their review, 10 issues remained. The FAA was now ready for presentation to the VCSA. The following issues were presented at a briefing conducted on November 12, 1992, in Washington, D.C.:

- ***Split responsibility for U.S. Army topography.*** Current Department of Defense directives and Army regulations split responsibility for topography between DCSOPS, Chief of Engineers, and Deputy Chief of Staff for Intelligence (DCSINT). Consequently, there is no single POC on the DA staff for topographic issues. Split responsibility makes it increasingly difficult to manage rapidly expanding digital data capabilities.
- ***Digital data communication requirement.*** There is an expanding requirement for digital topographic data and products at all levels. These demands potentially will swamp limited tactical communication capabilities.
- ***Direct support (DS) maintenance and repair parts availability for engineer units.*** Maintenance and repair-parts support for many engineer units recently was transferred to ordnance area support companies. Since then, engineer units have lacked timely DS support.
- ***Active diver requirement.*** The necessity for Army diving units in the active force was being questioned.
- ***Recruiting 00B and 52E personnel.*** It is difficult to recruit divers and prime power personnel because of the demanding entrance criteria and extensive training required for proficiency in these military occupational specialties.
- ***Career management field (CMF) grade structure.*** The 51 CMF grade structure lacks the promotion potential available in other CMFs.
- ***Commercial off-the-shelf equipment (COTS).*** Current Army procedures for acquiring COTS equipment do not provide equipment to support training or long-term maintenance requirements.
- ***Imbalance in the ACE/bulldozer fleet.*** Current distribution of the M9 ACE needs to be revised to change the mix of ACEs and bulldozers at the corps level. The ACE should be removed from the TOE of any unit, specifically light divisions, that will never receive the vehicle because of reduced procurement. Light divisions require the new deployable engineer universal combat

earthmover (DEUCE), which is a 30,000-pound bulldozer that can travel at 30 miles per hour and has a new rubber track that eliminates the requirement for prime mover. Additional ACEs are required to fill shortages in engineer units in Force Package 1.

- ***Digital data collection and generation.*** Current Army systems are unable to sufficiently exploit overhead civilian and military data collection assets. Army topographic engineers require an expanded capability to access these assets and provide near real-time topographic products to commanders. The topographic imagery integration prototype (TIIP) is a system of hardware and software that provides this capability. The current plan to field a single prototype system should be expanded to five systems—one for each of the four topographic battalions and one for the training base.
- ***Overaged, low density construction equipment.*** Much of this equipment is seriously overaged, but we do not expect to replace it in the current fiscal environment. While procurement is programmed in the POM, it is always deleted before the year of execution. No resources are currently identified to maintain the large quantities of overaged construction equipment that will remain in the field many years past projected life spans.

Issue Resolution

The FAA team worked closely with other Army agencies and commands during this period to define the solutions to each unresolved issue. In most cases, consensus was achieved on a preferred solution. Where agreement was not possible, multiple solutions were highlighted in the presentation. In response, the VCSA provided immediate support for the following programs:

- Procurement of the heavy assault bridge and breacher in the current POM.
- Procurement of TIIP systems for each topographic battalion and the training base in the FY 96 POM.
- Procurement of the DEUCE for light divisions in the FY 96 POM.
- Investment strategy of $25 million per year for procurement of low density engineer construction equipment in the current and FY 96 POMs.
- Establishment of an AMC task force to evaluate overaged engineer construction equipment.

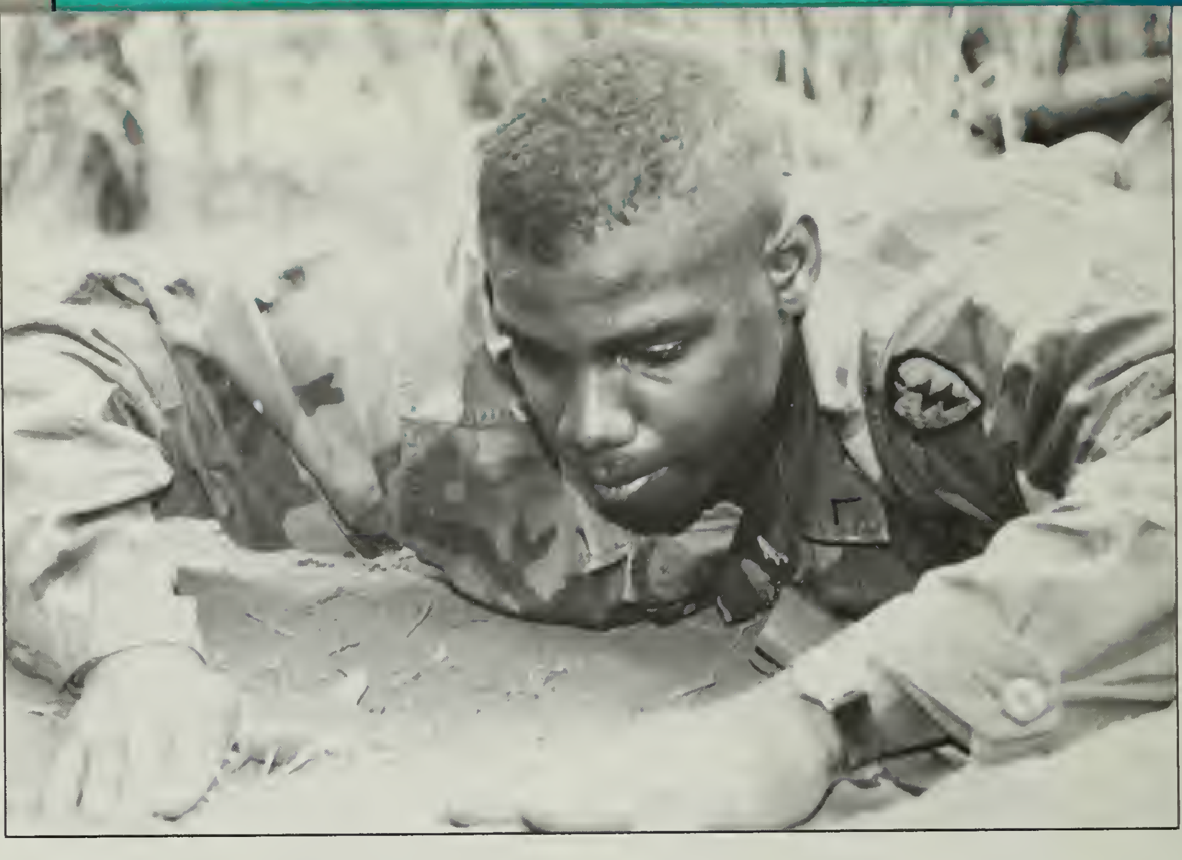
The VCSA tasked his staff and other Army agencies and commands to further evaluate more contentious issues and to return at a later date for final resolutions. He—

- Directed DCSOPS to fold diver requirements into ongoing Joint Chiefs of Staff's roles and mission studies and to bring COTS management and procurement under control.
- Directed the Deputy Chief of Staff for Logistics (DCSLOG) to include Class IX resupply for engineer DS maintenance sections in the ongoing total asset visibility and strategic communication initiative. Additionally, directed DCSLOG to develop a schedule to retire overaged engineer construction equipment.
- Directed FORSCOM to review engineer equipment stationing at the National Training Center. Pre-position the corps' slice of engineer equipment that normally would be tasked to support a maneuver unit. That equipment would be available to units participating in training at Fort Irwin.
- Directed his staff to prepare a topographic single POC issue paper for decision by Army leadership.

In closing, the VCSA praised the engineers for their outstanding efforts in Desert Shield, Desert Storm, and the disaster relief operations in CONUS. He indicated that these recent combat and peacetime actions prove engineer force versatility and support their future viability. He closed by saying that engineers are leading the Army's efforts to integrate the total force into the FAA process. He stressed that engineers must be vigilant as the Army's watchdogs in the environmental arena.

In all aspects, the 1992 FAA was an unqualified success. It reaffirmed the importance of the FAA process to engineers and the entire Army community. As a result, engineers are now better prepared to address upcoming fiscal and structural changes. By using the FAA process, engineers can view the future as an opportunity to manage change.

Colonel Leadbetter is chief of the Systems Priority Integration Division in the Directorate of Combat Developments at the Engineer School. He previously served as chief of the Engineer and Mine Warfare Divisions, of the Engineer and Mine Warfare Directorate at Fort Monroe, Virginia. COL Leadbetter has a masters degree in engineering from George Washington University and is a graduate of the Command and General Staff College and the National War College.



Engineers Vie for Expert Sapper Honors

"A test! I want to develop a competition similar to the Expert Infantryman Badge (EIB) and Expert Field Medical Badge (EFMB) competitions that we can use to demonstrate our skills as sappers. I want it to be a physically and mentally demanding event that includes the total spectrum of light engineer and light infantry skills required to operate in the 25th Infantry Division (Light). I also expect it to be an excellent training assessment for the battalion. At the completion of the competition, those who excel should be recognized by an award of some kind."

Lieutenant Colonel Gregory G. Bean
Commander, 65th Engineer Battalion
February 1992

From LTC Bean's directive, the expert sapper test was created and tested on soldiers in the 65th Engineer Battalion, Schofield Barracks, Hawaii. Captain Tom Vossman studied the directive and drafted objectives and procedures for the test. He analyzed the battalion's mission essential task list and supporting individual tasks as well as input from commanders, staff officers, and senior NCOs. Then he developed a list of skills and technical knowledge that included common tasks, sapper skills, air assault skills, and a physical fitness assessment. CPT Vossman's objectives were to—

- Develop a demanding and challenging test of sapper (12B) and common skills.
- Recognize sappers for their combat engineer skills and extraordinary physical readiness.
- Gauge the status of individual skill abilities to assess training proficiency.
- Provide a training as well as an evaluation opportunity.

By Captain Geoff Gillespie, Royal Australian Engineers

Thirty tasks, broken into five categories, were identified to support the objectives. The categories were a written test, a physical fitness assessment, day/night land navigation, hands-on proficiency in 25 individual skills, and a 12-mile road march. All 12B and 21B soldiers in the 65th Battalion, regardless of rank, participated. To earn recognition as an expert sapper, soldiers had to receive a GO on each task.

Written Test. A comprehensive exam was developed to determine the soldiers' knowledge of 12B (skill levels 1 through 3), air assault, and common task testing (CTT) tasks. It was a timed test, and Field Manual 5-34 was the only authorized reference. Soldiers had to score 80 percent or more to receive a GO.

Physical Fitness Test. This was the Army Physical Fitness Test (AFPT), using the EIB standard of 80 points per event to receive a GO. Standards for push-ups and sit-ups, according to FM 21-20, were strictly enforced.

Day and Night Land Navigation. Soldiers' navigation skills were tested using the division's EIB course. Soldiers had to attain four out of five points on day land navigation and two out of three points on the night dead-reckoning course.

Hands-On Component Test. This test was the heart of the competition. Soldiers demonstrated their ability to accomplish combat engineer tasks (skill levels 1 through 3), CTT tasks, and air assault tasks in a tactical environment. Events were graded on a GO/NO GO basis. Twenty-five tasks, including mine/countermine warfare, demolitions, knots, lashngs and wire tires, communications skills, weapons knowledge, sling load/air assault operations, and first aid, were tested. Standards were taken from the EIB, Expert Field Medical Badge, Air Assault school, CTT, and Soldier Training Plan manuals. Participants could retest on two tasks and still remain competitive.

The 12-mile road march was the make-it-or-break-it point for many candidates.

12-Mile Road March. This was the final and most grueling event of the competition. It was based on the EIB and air assault standards for a 3-hour march with full combat load (load-bearing equipment, weapon, mask, kevlar, and 30-pound ruck). What distinguished this road march from others was the course: more than half of it was uphill, including a 3-mile stretch that rose more than 1,000 feet with several short, sharp inclines. Several veterans of the ranger, sapper, and air assault courses remarked that this road march was the most challenging of their careers. The course definitely helped to identify those soldiers who were extremely physically fit and deserved the title Expert Sapper.

The Rewards

Sappers in the 65th designed a pin and a certificate for test participants. Soldiers who passed all the test components were awarded the expert sapper pin, which can be worn on an invisible part of their uniform. All the soldiers, whether they passed or failed, received a certificate to acknowledge their participation in all phases of the grueling competition.

How the 65th Fared

Scheduling the competition was difficult because the 65th is a divisional light engineer battalion whose companies are continually on the go. The unit frequently supports the Joint Readiness Training Center and deploys to Australia and the outer islands of Hawaii. Finding a time when all companies could train up and participate in the competition without major distractions was nearly impossible. However, the battalion managed to come together, and all 12B and 21B soldiers competed and performed well. Success, for this first-time competition, came to only seven soldiers. However, all participants left the competition better trained and eager to compete again for the expert sapper title.

After-action reports from the 65th

The Expert Sapper Test emphasised testing and training. Each candidate was thoroughly debriefed on their performance for each activity. Here SSG Chapman assesses SSG Lee's knowledge of the AN-PSS 11 mine detector.

showed that all levels supported two main areas: the test's ability to determine extraordinary soldiers and its training value. Many of the 65th's young privates and specialists were excited and challenged when they had to demonstrate their abilities on skill levels two and three tasks. Testing at these levels gave the soldiers an idea of what they could expect to do as a team or squad leader in a combat situation. They could start meeting the challenges of the future.

Soldiers at all levels gained an understanding of the skills and standards that they had to meet. Specialist Christopher Kelly, Headquarters and Headquarters Company, expressed his view of the test. "The things I failed I felt were minor. I now know what I need to do. I think that with good personal preparation next year, I can pass. It was a good test."

By studying the test results, leaders could identify areas where more training or better training tactics were needed. The commander gained insight into individual soldier's abilities in terms of skills, spirit, morale, and endurance. First Sergeant Michael Balch, Alpha Company, agreed. "The [expert sapper] test is an excellent idea to use as a vehicle to train our soldiers toward a goal of achieving expert knowledge in their primary MOS."

The 65th Engineer Battalion is proud of its expert sapper competition and will share the program with anyone who asks. They intend to conduct the test annually and hope to increase the success rate to 25 percent or higher next year. Thucydides, in *History of the Peloponnesian Wars*, may have stated it best when he said, "We must remember that one man is much the same as another, and that he is best who is trained in the severest school."

Captain Geoff Gillespie, an Australian exchange officer, is assigned to the assistant division engineer section in the 65th Engineer Battalion, 25th Infantry Division (Light), Hawaii. He is a 1982 graduate of the Officer Cadet School, Portsea, Australia.

(Personal Viewpoint continued)

Why Now?

It is important that we act now for two reasons. First and foremost, we engineers need to restore our credibility with the combined arms force. We are now, and have been, unreliable because our CEVs are hard to maintain and often are not available. Far too many maneuver commanders literally scoff in disgust at CEV readiness. That skepticism is starting to join a festering (though undeserved) disdain for the capabilities and reliability of the M9 ACE. Because the engineers' reputation is in precarious jeopardy, I strongly urge us to act quickly. Our engineer force will overcome this skepticism only when we replace the CEV with a reliable breaching vehicle and when we demonstrate the reliability of the M9 ACE.

Secondly, the resource environment will never be better than it is now. In the near future, already scarce resources will become even scarcer, and competition for the few remaining resources will be brisk. Now is the time to demonstrate the merits of an M1 chassis for our interim breaching needs.

There are more issues to this debate (on both sides), but time is running out. One bright note: My division commander, Major General Blackwell, is solidly in favor of replacing the CEV with an M1 with plow, and he has formally submitted a proposal to Major General Christman for consideration. Perhaps you'll join us in supporting this proposal!

Colonel J. B. (Jack) O'Neill is commander of the 24th Infantry Division (Mechanized) Engineer Brigade. His previous heavy division experience includes service in the 16th Engineer Battalion, 1st Armored Division, and as battalion commander, 17th Engineer Battalion, 2nd Armored Division.

Book Review

This Kind of War: A Study in Unpreparedness, by T. R. Fehrenbach. Macmillan, 1963, and Bantam Books, 1991.

T. R. Fehrenbach tells the fighting soldiers' story of the Korean War, from the surprise invasion through the difficult fighting on the harsh terrain of the Korean peninsula to its inconclusive ending. The lessons learned from this conflict must not be lost on our newly elected President and his chosen domestic, international, and military advisors. We have heard military leaders tell us, "No more Task Force Smiths!" But we and our political leaders must understand this tragedy in order to prevent a similar occurrence in the future. To ensure we provide leaders with appropriate advice, all of us must also understand the individual and unit readiness requirements of our armed forces. This is especially important in light of the current force reduction.

This Kind of War is a comprehensive and impressively written history compiled from many sources—official records, operational journals, histories, memoirs, and newspapers. The most important references were the personal narratives of men who served in Korea. They added a human character to the book, making it extremely interesting to read as well as a learning experience.

The book begins with a superb short overview of the political and military situation at the time. In fact, the reader has a clearer picture of the world in 1950 than the President had. Fehrenbach continues the book as a platoon leaders' and company commanders' story. It is a history of their experiences, pain, suffering, and unpreparedness. Fehrenbach immediately draws you into the heart of the subject and does not let you exit until the book is finished. Early on you are alongside the courageous Colonel Smith and his men from the untrained 24th Infantry Division, asking what you could have done to stop the superior invasion force. Later you are with the 7th Marines, fighting well-trained Chinese at the Chongjin Reservoir, and then with the 2nd Infantry Division on Heartbreak Ridge.

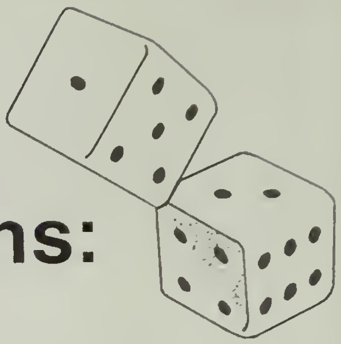
The author was a combat leader at platoon, company, and battalion levels during this war. Using his experience and many personal interviews, he describes the feelings, pressures, and fears of the soldiers, which enables the reader to understand the actions and frustrations of those who fought. Readers can apply this to their own experiences and begin to appreciate the problems forces faced in Korea.

Every lesson that we must teach junior leaders in our modern Army is covered in this book. The more you study history, the more you find that these lessons do not change—and they recur every time an army is mentally and physically unprepared to fight. Soldiers in small units can use this book in their training (at the platoon level war does not change). Soldiers live and die by their training, and the best trained soldiers and units have the edge on survival.

This book must be read and re-read by every company-level officer in the U.S. Army. We are an army that is coming home, (just like after World War II), and we must be trained for contingency, short-notice operations. The Korean War was a contingency operation that got out of hand—something we must not let happen again. We must properly prepare and equip our soldiers for the first fight, where they must win.

This book also must be read by our senior civilian and military leaders. There will always be some risks built into the defense budget, but the risks must not be at the expense of our soldiers. The author points out how critical that concept is. We must still procure the best weapons for our fighting soldiers. We must provide them the mobility required for success. We must continue to provide them the best training, like that offered at our combat training centers. *This Kind of War* provides an excellent perspective on war and soldiers, and what they require to survive and be victorious.

Lieutenant Colonel (R) Roger J. Somerville is a retired combat engineer. Commissioned through the ROTC program at Montana State University, he served in numerous troop assignments in the 82nd Airborne Division, 1st Armored Division, and 177th Armored Brigade. His last assignment was as chief, Tactics, Training and Doctrine Division at the Engineer School.



Gambling with Demolitions:

What are Safe Distances?

By Master Sergeant William Green, Jr.

Boom! A loud explosion rips through the air, and a cheer rings out from happy soldiers. Another successful demolition mission. But, wait! A strange sound is heard, followed by a weak scream for help. An accident—an unplanned event—has occurred. A soldier was struck by a piece of shrapnel.

This tragic scenario has occurred 32 times in the past four years, resulting in four deaths and 28 seriously injured soldiers. Not long ago a piece of metal was propelled from a detonation site into the face of a soldier standing behind an ammunition vehicle 200 meters away. Although the shrapnel removed most of his face, the soldier is still alive.

"A freak accident," you might say, or "the price of doing business," or "accidents come with the profession." You have probably heard leaders repeat these or similar phrases throughout your career. A more appropriate phrase, however, is "failure to enforce the standard."

Maintaining a safe distance is critical to avoiding a demolition accident. A few months ago, a soldier in one unit was sitting on the ground about 180 meters from a detonation site when a piece of shrapnel struck him in the chest. He lived only 3 hours. Again, leaders had failed to ensure the minimum safe distance from the detonation.

For those few engineers who have missed the experience of standing in a 5-second hailstorm, don't live your fantasy on a demolition site. That's called gambling with your life. Gambling that a piece of shrapnel or debris has not identified you as its landing zone.

What are the odds that a piece of shrapnel has the trajectory and force to seriously injure or kill a soldier? That tough question depends on several factors: The number of demolition missions taking place on any given day worldwide, the number of soldiers participating in the demolitions, and the amount of debris and fragments that becomes airborne. Other variables that affect the equation are the weight and shape of the demolition, soil content, air density, angle of projection, and velocity. The result is a complicated equation by which to determine your odds.

But for the 32 soldiers involved in explosives accidents in the past 48 months, the answer is simple: Enforce the standard!. The common-sense standard says that the greater the distance you are from the explosion, the smaller the chance of being struck by shrapnel.

Some leaders continue to knowingly violate the minimum safe distances rather than enforce the standard. To be safe, leaders must go to the appropriate documents for guidance. When these documents differ, use whichever distance is the greatest.

The purpose of all demolition training is to prepare for combat, where the reality is that soldiers cannot always move to a safe distance. With that in mind, every leader must ask himself, "Do the training risks outweigh the cost?" To minimize the risk in any situation, the Safety Branch recommends that leaders use the best product on the market today: risk management. This easy-to-use product can enhance soldiers' safety without hindering the success of a mission. Risk management ensures that standards are known and risks are controlled (eliminated or reduced).

To be effective, the rules and five-step process for risk management must be fully understood by all personnel involved:

Rules of risk management:

- Integrate risk management into planning
- Accept no unnecessary risks
- Make risk decisions at the proper level
- Accept risk if benefits outweigh the cost

The five-step process:

- Identify the hazards and associated risks
- Assess the risk
- Develop controls
- Implement controls
- Supervise

It is the responsibility of leaders at all levels to ensure subordinates know and follow the rules and regulations that pertain to ranges and the type of demolition training being conducted. The risk management process is easy to use and will identify control measures that may prevent another pointless injury or death. Don't be a leader who has to say, "If only I had enforced the standard, this accident would not have happened."

Standards for demolition training are provided in Chapter 18 of AR 385-63 and Chapter 6 of FM 5-250. Know and enforce them. Minimum safe distances for some demolitions are shown below.

MSG William Green Jr. is the Engineer Branch Liaison NCO at the United States Army Safety Center, Fort Rucker.

Minimum Safe Distances

Demolition Type	AR 385-63	FM 5-250 (pages 6-6 and 6-7)*
Bare charges	Use the missle hazard distance: *Less than 27 pounds* (lbs) - 300 meters (see para 18-11 for exception *27 - 500 lbs* - distance in meters equals 100 times the cube root of the pounds of explosive *More than 500 lbs* - minimum of 800 meters	Same as AR 385-63, as shown on page 6-6, FM 5-250
Cratering charges		
40 lb	Use the missile hazard distance (above)	*Less than 30 kg* - 300 meters *More than 30 kg* - 500 meters
M180	Not mentioned in AR	1,200 meters
Shaped charges		
15 lb	275 meters in defilade	1,000 meters. Distance may be reduced to 300 meters when fired vertically into the ground.
40 lb	Same as for 15 lb	Same as for 15 lb
M1A2 Bangalore torpedos	500 meters if no shelter is available 200 meters in defilade	1,000, meters if personnel are at right angles to axis. If in the line of axis, 200 meters for standing personnel and 100 meters for prone personnel.
Steel cutting charges	Charge not to exceed 2 pounds. Must be fired in an appropriate confining structure with an excavated pit at least one meter deep. If fired in an open pit, a mat made of hemp-type material should cover the charge. Personnel should be at least 300 meters away in defilade, preferably under cover.	1,000 meters
Breaching charges (concrete)	Charges on concrete should not exceed 40 pounds and should be placed on the side nearest the observers. Personnel should be at least 300 meters in defilade. An unoccupied distance of 900 meters must be provided on the side opposite the charge.	1,000 meters. Distance may be reduced to 500 meters if personnel are prone and wearing kevlar.

For FM 5-250: Numbers from chart on page 6-7 must be compared to chart on page 6-6. The safe distance is the farthest of the two distances.

Close Up:

Engineer Restructure Initiative

By Alan Schlie

> *"Our objective is to be available at the front line of troops (FLOT) and in the deep attack to be capable, protected, mobile, and productive and, most important, to be responsive to the maneuver commander. But new equipment alone is not the panacea We must forge a new engineer architecture. We need—*
>
> - *More compact units with a higher ratio of equipment to manpower.*
> - *Greater integration with the Army field structure at all levels.*
> - *A forward shift in command and control.*
> - *Reduced overhead and greater productivity "*

As Commandant of the U.S. Army Engineer School, Major General Richard S. Kem's announcement in 1986 set in motion events that would mesh engineer missions with AirLand Battle tenets and lead to the current Engineer Restructure Initiative (ERI). With the expected publication of an evolutionary FM 100-5, *Operations*, in May 1993, the term AirLand Battle (ALB) and the concept of AirLand Operations (ALO) will no longer be used, but the tenants remain unchanged. This article describes the ERI structure, how it was fielded, and results of the fielding.

Background

Since World War II, engineers have faced serious battlefield deficiencies because of cumbersome organizational structure and antiquated equipment. Engineer support to the close combat heavy combined arms team was broken, and there were not enough engineers organic to maneuver forces. Attempts to correct the problem by assigning ad hoc task forces forward out of corps assets overloaded engineers at all echelons. Command and control (C2), communications, maintenance, and logistics became complicated to the point of not working as battles progressed. Additionally, such impromptu structuring fostered a false sense of flexibility at the corps level.

The ERI Solution

ERI, developed in 1988 and 1989, provided sufficient engineer assets organic to the division and simplified command and control, communications, maintenance, and supply. Under this concept, engineers would habitually associate with a warfighting maneuver unit, thus increasing responsiveness and building teamwork. ERI's focus was not only on the heavy division but also on providing maneuver commanders at corps and division levels with dynamic, flexible, and responsive engineer support to influence the battle. Restructuring corps combat engineer battalions, combat support equipment companies, and bridge companies retained the corps' capability and flexibility.

TRADOC reviewed the heavy division engineer brigade's ERI table of organization and equipment (TOE) in October 1990. Headquarters, Department of the Army (HQDA) approved the TOE in March 1991, and the 1st Armored Division and 3rd Infantry Division, located in Europe, converted in August 1991. The conversion process in engineer units Army-wide has continued since 1991, with all but National Guard units now converted. The new organizational structure embodied combined arms teamwork and current warfighting doctrine. During the developmental and approval time frame, TRADOC and HQDA had three ongoing force-design processes that impacted on the engineer force structure and ERI:

- TRADOC's AirLand Operation force-design process focused on lean not robust.
- The Total Army Analysis (TAA) 99 force structure review process examined major conflict areas

and how the Army would respond to national security threats.

- The Army was restructuring to reduce conventional forces in Europe.

The ERI design anticipated changes that ALO would cause in divisional headquarters and maneuver brigades. This was done by creating the dual tactical operations center (TOC) of plans-operations, a tactical command post (TAC), and a REAR. The requirement for an engineer presence at these locations came from the ALB-Future White Paper and TRADOC Pamphlet 525-5, *AirLand Operations*.

Under ALO, the engineer brigade headquarters and headquarters detachment (HHD) would disappear, and selected positions would be retained as part of the division's staff. These positions would be included in the division HHC TOE. Engineer battalions would become organic to the maneuver brigades. While retaining their identity, these battalions would lose their support platoons to the forward support battalions (FSB). To prevent excessive loss of engineer personnel through these consolidations, personnel strength caps were imposed. This meant that specific officer functions could not be documented.

The new FM 100-5 does not call for the force structuring advanced by ALO. Thus, if ERI did not evolve as previously planned, the original organizational structure would remain solid. The primary intent was to correct recognized battlefield deficiencies, not second-guess future force structure and doctrine.

Under the ERI design, the engineer brigade headquarters provides advice and assistance to the division staff. The focus is strictly engineer, and the commander in the field must be innovative in the techniques employed to provide that support. The brigade HHD cannot provide combat service support for the subordinate engineer battalions and is extremely limited in supporting itself.

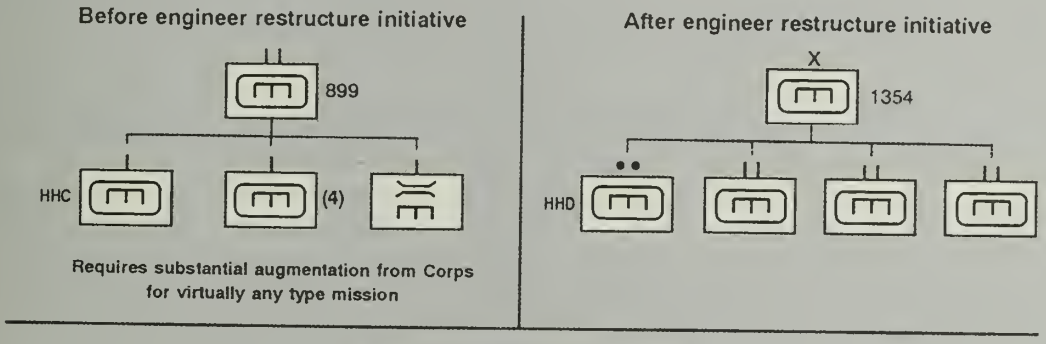
The brigade HHD depends on the division HHC for its combat service support. Therefore, it is essential that the division HHC be capable of providing that support when the brigade HHD is established in the field. To correct any support deficiencies, it may be necessary to change the division HHC's modified table of organization and equipment (MTOE). At the beginning of ERI development, the Engineer School recognized that TOCs operated on a 24-hour basis and required double-shift manning, so trade-offs were necessary when strength caps limited what was allowed.

ERI Issues

The following issues concerning personnel and equipment were identified by field commanders when they tested the ERI structure:

Personnel S2 Officer. This position focuses on gathering engineer intelligence on the opposing force. Collecting general military order of battle information is of secondary importance. Multiple shifts and

Division Comparison


Before engineer restructure initiative

After engineer restructure initiative

Requires substantial augmentation from Corps for virtually any type mission

Changes caused by ERI

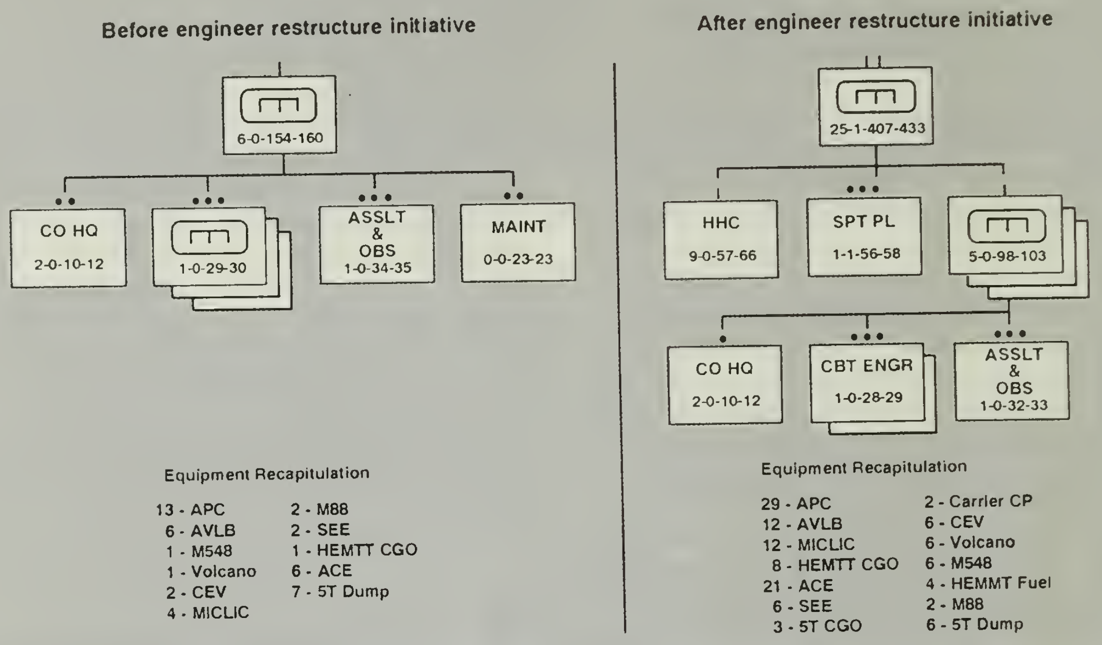
Better command and control capability to receive corps augmentation

Corps units task organized based on METT-T

All bridging (less AVLBs) pooled at corps, task organized to divisions based on METT-T

Most sustainment engineering and heavy survivabilty equipment pooled at corps

Structure Comparison
Engineer Support to Maneuver Brigade



locations dictate that more than one officer must have S2 skills. Thus, the TOE includes several plans and operations positions that have overlapping knowledge and skills in the intelligence arena. An NCO monitors the reconnaissance and intelligence collection effort and performs full-time security duties. The brigade HHD has an MI-qualified tactical intelligence officer to monitor general intelligence work.

Communication-Electronics (C-E) Officer. It was not possible to duplicate this position at both the brigade and battalion levels. While the position's importance was not overlooked, supervisory strategy was the compromise. A C-E officer at the brigade level (assisted by an NCO) distributes signal instructions and plans C-E networks. NCOs at battalion and company levels complete that strategy.

Maintenance Officer. The need for this position was recognized initially but was not documented based on the priorities used to select officer positions. The brigade maintenance warrant officer (WO) and senior NCO track maintenance and readiness at the brigade level. The WO also provides expertise for engineer equipment maintenance within the brigade. At the battalion level, the support platoon has a platoon leader, platoon sergeant, WO, and motor sergeant, each with specific duties to support the commander's maintenance plan.

NBC Officer. Because the brigade staff is located close to the division staff, there is no NBC officer assigned at the brigade level. NCOs with NBC responsibilities are provided at the brigade and battalion levels.

Chaplain. When the TOE was approved, manpower regulations did not authorize a chaplain in the engineer battalion. The chaplain from the maneuver battalion was expected to provide services for engineers as well as infantry and armor personnel. A two-person ministry team was eliminated from the HHD because the unit was small and an extension of the division staff.

Equipment Records Clerks. The TOE consolidates equipment records and repair parts at one location to save overhead. While contact maintenance teams will be sent out when necessary and individual mechanics may be attached to platoons or companies, they will all belong to a single maintenance section. Consolidation makes it almost impossible to break the unit into equal groups.

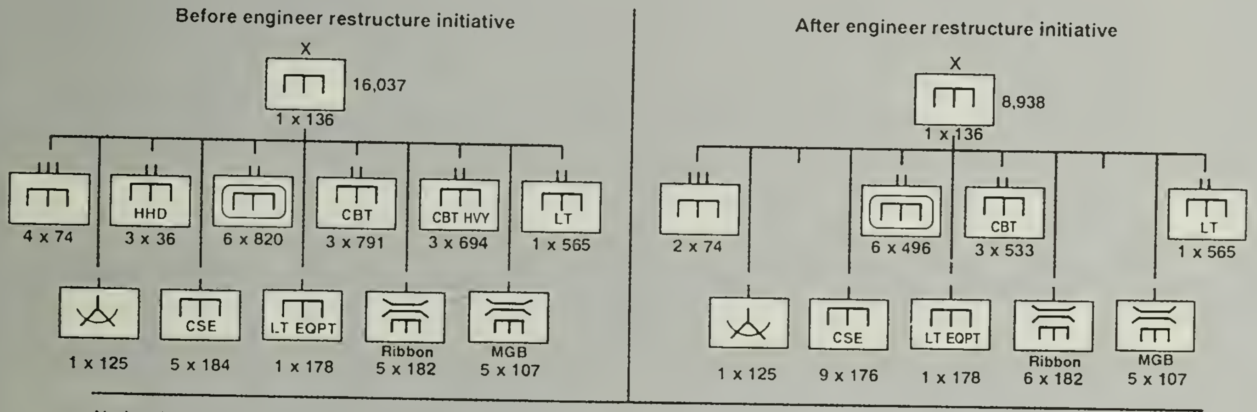
Drivers. The addition of vehicles and drivers for executive officers (XOs), command sergeant majors, and first sergeants was not supported doctrinally by the engineers. While transportation for the unit's "problem solvers" remains a very real need, the TOE cannot be changed until vehicle allocation rules are revised. The Engineer School therefore had to choose either a wheeled or tracked vehicle for the battalion commander. Because the XO's tactical position is at the TAC, the school decided that the battalion commander needed a tracked vehicle to facilitate movement on the battlefield. The XO's wheeled vehicle would be available for either officer, when required.

Field Feeding. This initiative, developed by the Quartermaster School and approved by the Chief of Staff of the Army, was implemented Army-wide in 1989. Under the Army field-feeding plan, a soldier is fed by the nearest facility. The Quartermaster School developed ration issue and accounting procedures to accommodate this method of field feeding. Units must adjust their method to accommodate local circumstances. The Quartermaster School is evaluating comments from the training centers and will solve problems caused by the increased coordination, planning, and expended manhours.

Equipment Some equipment changes have already been approved and incorporated in the Commander's TOE Handbook (DA TOE Handbook 05330L-CTH), which is scheduled for publication in mid-1993. Inclusion of the following items in the base TOE, as published in the consolidated TOE update, is scheduled to occur by April 1993:

- A water trailer and camouflage netting have replaced the collapsible drum and its tiedown and the towing and lifting assembly in the engineer company (TOE 05337L).
- Two small emplacement excavators (SEEs) will be retained in each engineer company. Operator spaces for these vehicles are created by converting two 12Bs to 62Js in the obstacle section. Additional support equipment for the SEE is also included.
- The Engineer School has requested that engineer companies retain two 5-ton dump trucks in the obstacle section. The maneuver brigade has very limited capabilities to transport the required amounts of barrier and demolition materials. Thus, if engineers need materials to execute mobility and countermobility tasks, the 5-ton dump trucks, as existing, on-hand equipment, can rectify the shortfall. This request is still under consideration.
- The support platoon (TOE 05536L) will receive four engine analyzer sets. This will allow one simplified test equipment/internal combustion engine (STE/ICE) to be deployed with each contact maintenance truck while one is maintained at the maintenance section's field site. The support platoon will have two steam cleaners instead of one to increase their maintenance and decontamination capabilities.

Corps Comparison



Notional corps engineer brigade generated by a corps of 3 heavy divisions, 1 light infantry division and 1 armored cavalry regiment

Changes caused by ERI

Downsized combat battalions → Greater deployability and agility

Maintaining combat battalions at corps → Corps commander retains flexibility

All bridging assets (less AVLBs) pooled at corps, task organized to divisions

CSE companies are repository of heavy survivability, countermobility equipment

Combat heavy battalions become "EAC" asset, retain responsibility in corps area

What ERI Did

- Engineer brigade created with three engineer battalions in armored divisions
  - One battalion for each ground maneuver brigade
  - No "dedicated" engineers for divisional cavalry squadron, aviation brigade, or other divisional units
- All divisional bridging reorganized and moved to corps
- Divisional engineers focused on offense and mobility
  - Design was parallel to AirLand Battle-Future workshops
  - Design assumed 80 percent offense, 20 percent defense
  - Design provided only for a hasty defense
  - Scatterable mines provided dynamic countermobility capability
  - Survivability capability severely curtailed
  - Sustainment engineering capability was not a priority
- Significant combat engineer capability remained at corps
  - Mechanized engineer battalions
  - Wheeled combat engineer battalions
  - Combat support equipment companies
  - Assault float bridge and medium girder bridge companies

Nonengineer Issues

The following ongoing initiatives are outside the engineer functional area but will impact on revisions to the ERI TOE:

- The chaplain manpower rule was changed so that a chaplain with an assistant and a vehicle will be placed in each battalion and in the brigade.
- The mail clerk manpower rule was changed so that each battalion will have a mail clerk.
- The chemical officer manpower rule was revised so that each brigade staff will have two chemical officers.
- The PAC clerk rule was revised so that each battalion will have one additional clerk.
- The supply clerk rule was revised so that each company will have a supply specialist.
- A three-medic crew is assigned to each APC that is used as an ambulance. Those APCs will be added to the battalion in sets of two.
- The legal clerk rule was revised so that each battalion will have one clerk.

The latest manpower initiative readjusts the planning factors used to determine the annual available MOS productive manhours (AAMPH). By increasing the AAMPH, the number of persons needed to perform a function, such as supply clerk, is reduced. While the AAMPH directly affects the number of mechanics, it "bleeds" over into all manpower requirement calculations. The Engineer School has not yet validated the final impact of this initiative.

While these changes may not seem significant, they improve capabilities without disrupting the approval process for ERI and without impeding the plans to field ERI organizations. Both were key considerations at the time, since the Engineer School's intent was not to change ERI until many of the conversion pains were worked through and the dust settled.

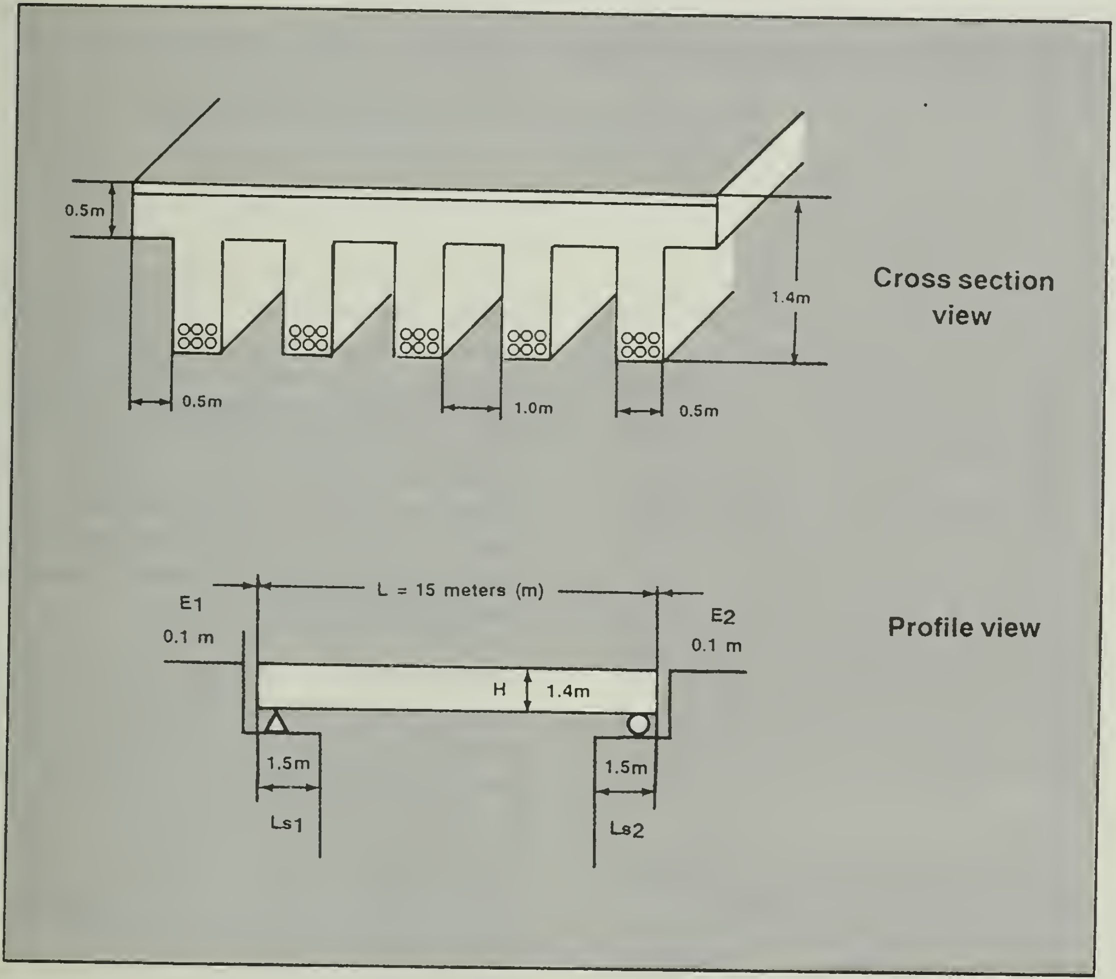
To better support the ERI battalions within the heavy division, ordnance and quartermaster proponents have increased the number of personnel in the forward support battalion and the main support battalion (MSB). The maintenance company, FSB (TOE 43009L000) has added a 17-soldier engineer support team. In response to the division's increase in engineers, the main support company (TOE 42004L100) has been increased by three soldiers and the service and support company, MSB (TOE 42007L100) has been increased by seven soldiers. Engineer brigades in heavy divisions should coordinate with their installation MTOE manager to ensure the proper support units are documented.

The Engineer School's Directorate of Combat Developments is reexamining ERI requirements based on the revised FM 100-5 and its evolution of current operational precepts, as opposed to full acceptance of ALO concepts. Sufficient field experiences during war and peace time have been validated and will allow meaningful changes to be made to the engineer brigade, heavy division TOE.

Alan Schlie is a military organization and equipment analyst with the Directorate of Combat Developments. A retired command sergeant major, most of his active duty career was spent in divisional engineer battalions.

Engineer Problem

PROBLEM: Determine the most efficient method of destroying the simply supported, reinforced - concrete, beam and slab bridge shown below using C4 explosives.



Reference: FM 5-250.

Engineer Solution on page 35.

Lessons Learned:

Disaster Assistance Missions

By Major James R. Brannon

The following Lessons Learned address disaster relief. In the past three years (September 1989 - September 1992), U.S. military forces have responded to three hurricanes and two typhoons that struck densely populated areas. After the most recent storms, Hurricane Andrew in Florida and Louisiana and Hurricane Iniki in Hawaii, Army engineer soldiers provided relief services, cleared and hauled debris, produced and distributed water, restored power, and constructed life support centers (tent cities). These missions revealed important lessons in preparedness, leadership, organization, equipment, and safety. For more information write to Commandant, U.S. Army Engineer School, ATTN: ATSE-ESA-L, Fort Leonard Wood, MO. 65473-6630. Or, call (314) 563-5303, DSN 676-5303.

ISSUE: To rapidly deploy the right combination of forces and equipment tailored for a disaster is difficult. Lack of specific mission guidance and poor engineer intelligence from the disaster zone combine to make such deployments especially challenging.

DISCUSSION: A few units that deployed to Florida found they were short of needed tools, sets, kits, and outfits (SKOs). Some also lacked critical haul capability for heavy equipment. While those challenges were overcome through an unprecedented joint operation, some units could have been better prepared.

Engineers responding to natural disasters must be prepared to accomplish a variety of horizontal and vertical missions. For hurricane clean up, a primary task is debris removal. This requires large numbers of chain saws, dump trucks, and bucket loaders. An unanticipated mission in Florida was the massive effort required to clean up and open several dozen elementary and secondary schools, which entailed extensive electrical and interior work. The requirement to set up life support centers created heavy demands for carpenters and electricians (and their SKOs). Not everyone brought all their tools. One commander observed: "The initial engineer mission NEVER includes all eventual tasks! Nobody is smart enough to define everything in advance."

RECOMMENDATION: If possible, units should take their entire TOE to a disaster site. They should take all SKOs, generators, chain saws, pumps, and lighting sets. Anticipate the need for light- and heavy-duty electrical work, temporary tenting, power generation and lighting, carpentry, temporary plumbing, water purification, and road clearance. To increase haul capacity, take side racks for cargo trucks. Take portable lights and generators, which can do double duty for round-the-clock construction and operations.

ISSUE: Disaster areas face critical shortages of needed supplies and construction materials. Lumberyards, hardware stores, and other vendors may be closed or destroyed. Items these suppliers normally provide may not be available.

DISCUSSION: The scope of the damage from Hurricane Andrew was unprecedented. Almost every item for basic human needs had to be hauled in and distributed. While this was captured in local and national news, the need for plywood, nails, tools, plastic, canvas, electrical wire, and other hardware items largely went unnoticed. Be aware that in any disaster area some local vendors may engage in price gouging.

RECOMMENDATION: Within reason, purchase equipment and materials you are likely to need before deploying. Specifically: Purchase additional chain saws with extra blades and chains (allow for two 24-inch models per squad, and one 30-inch or 36-inch model per platoon). Units will also need plywood, forklift pallets (they make excellent foundations for tent flooring), nails, exterior Romex type electrical cable, duct tape, electrical tape, PVC glue and sealant, 12-foot and 16-foot ladders (for hanging cable and interior electrical work), and some fluorescent lighting fixtures (for tents). Take the National Electrical Code (NEC) book to ensure your work is up to a standard that can be hooked into city power.

ISSUE: Hurricanes and other disasters often destroy all major means of communications. Telephone lines, power poles, radio towers and transmitters, and cellular telephone towers may be out of service for days or weeks. Communications will be a premium issue for engineer units.

DISCUSSION: Hurricanes Andrew and Iniki knocked out all communications. In Dade County, Florida, only two of five cellular telephone towers survived the storm. Because communications systems for Active, Reserve and state National Guard forces vary widely, cellular phones may be the best way for federal, state, and local agencies to keep in touch. In Florida, for example, Army reserve frequency modulated (FM) communications were not compatible with mobile subscriber equipment (MSE) from the XVIII Airborne Corps. Additionally, local police, fire, county sheriff, ambulance services, hospitals, and municipal governments could not communicate with military forces. Military FM and civilian FM used entirely different frequency bands and were incompatible. While the best overall military communications system for static use was MSE, cellular phones were valuable, especially when communicating with other mobile military forces or civilian agencies. Local police all carried cellular phones. By using cellular phones, Army units increased their operational credibility with many civilian agencies.

RECOMMENDATION: Contract for and take at least enough cellular phones to mimic the unit's command net. Use FM radios, citizen band (CB) radios, and cellular phones to communicate with civilian agencies, people who are stranded and need help, and each other. Be prepared for confusion and disjointed communications in the area of operations. Other "communications" devices you may need include portable facsimile (fax) machines, personal computers (and lap-tops), MCS computers, copy machines, and MSE fax machines. Be aware that you may need to modify a computer with a fax board to interface with an MSE fax machine.

ISSUE: Large natural disasters probably will require more federal military aid than one DOD agency can provide. Joint operations with Army, Navy, Marines, Air Force, Coast Guard, or allied forces may play a role in disaster relief. This type of operation requires unique skills, knowledge, and special duties.

DISCUSSION: Throughout the area of operations, military commanders must integrate with several overlapping civil governmental agencies (city, county, and state). Public utilities (water, electrical, phone, gas, sewage, and garbage) operate across broad political and geographic areas, and each has its own organization and relationships with local governmental agencies. Because military units in Florida did not understand these interrelationships and levels of authority and responsibility, it was difficult for them to coordinate work and communications. Maneuver commanders who carved up an area with divisional boundaries found themselves slicing up cities, counties, and municipal and county utility districts. As a result, city and county agency personnel were confused as to which military commander was "in charge." This created a need for multiple liaison officers, burdened communication systems, and caused some duplication of work effort.

RECOMMENDATION: By using the intelligence preparation of the battlefield (IPB) process as a guide, engineer commanders should know the level of coordination that exists in the disaster area. They must determine if municipal governments have coordinated utility support and repairs, where the top authority lies, and who is in charge. They must become familiar with police and fire jurisdictions, public utility districts, and hospital districts.

If coordination between agencies is broken, engineer commanders must help "fix" it. The objective is to re-establish the local government's ability to function properly. Thus, normal channels of operations should be employed to the maximum extent possible. Be prepared to commit liaison officers to as many levels of government as necessary to keep communications open and missions orderly. Officers and senior noncommissioned officers should be familiar with the way local governments and public utility districts operate. They should also be familiar with the capabilities and structures of Navy Seabees, Marine engineers, and Air Force base civil engineering squadrons and Prime Beef Units.

(Continued on page 31)

The Sheffield Method of Bridge Demolition

By Major Ira Joe Davis

The U.S. Army has used explosives to destroy bridges for decades but has never had a process to identify the most efficient way to do so. This problem was resolved by integrating the Sheffield method of bridge demolition into Chapter 4 of FM 5-250, *Explosives and Demolitions* (June 1992). The method is described in Chapter 4 but is not labeled as "Sheffield."

The Sheffield method is a result of a study conducted by the Department of Civil and Structural Engineering at the University of Sheffield, England, from September 1971 to August 1974. The study, directed by the British Royal Armament Research and Development Establishment, analyzed existing bridges under dynamic loading conditions. It also developed procedures to ensure the most efficient use of explosives in performing bridge demolition missions. Their data base included analysis of more than 15,000 European bridges. Researchers compared their findings with existing British and U.S. Army doctrine for bridge demolition missions. By adopting the Sheffield method, the U.S. Army standardized bridge demolition procedures among the American, British, Canadian, and Australian (ABCA) armies.

Bridge Demolition

The purpose of all bridge demolition missions is to create gaps in the bridge by attacking key bridge components. The intent is to create gaps large enough to defeat an enemy's assault bridging capabilities and render the bridge militarily unrepairable. This forces the enemy to concentrate efforts on other crossing sites or to attempt deliberate bridging operations. Either way, it slows the enemy's momentum.

The minimum desired gap is 5 meters greater than the enemy's assault bridging capabilities. For planning purposes, the minimum gap is 25 meters, but the preferred gap is 35 meters. To obtain the minimum gap on spans less than 25 meters, one or both ends of the bridge are cratered. Demolished bridge sites should be mined, and the debris should be booby trapped to further slow the enemy's bridging efforts.

Two minimum conditions must exist to ensure successful bridge demolition:

- A collapse mechanism must be formed.
- Once formed, the collapse mechanism must be allowed to move far enough under the bridge's weight to create the desired obstacle.

Bridges are stable structures. They must support their own weight (dead load) plus the weight of the crossing traffic (dynamic live load). The intention of the Sheffield method is first to identify the critical members of the bridge for destruction so that the bridge collapses under its own weight (the collapse mechanism). Second, the bridge must have sufficient space to move as it fails to prevent jamming or pinning. All bridge demolition missions are designed to be completed with a minimum amount of time, manpower, and explosives. Previous U.S. Army bridge demolition doctrine did not address these concerns.

Bridge Types and Bridging Principles

To use the Sheffield method properly, engineers must first categorize the bridge as a simply supported, continuous, or miscellaneous structure. Bridges may have either single or multiple spans. A multiple-span bridge may contain both

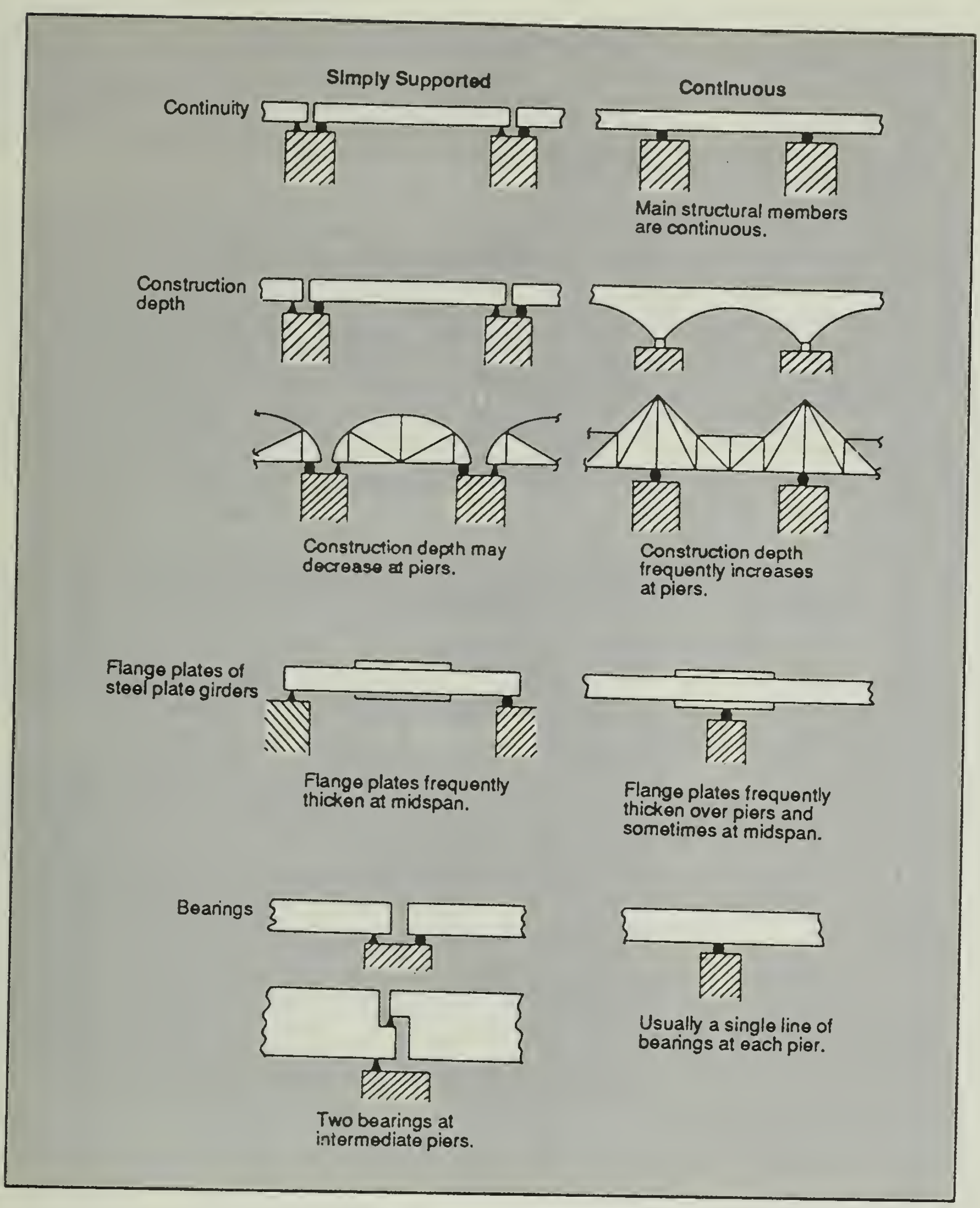

Simply Supported
Continuous
Continuity
Main structural members are continuous.
Construction depth
Construction depth may decrease at piers.
Construction depth frequently increases at piers.
Flange plates of steel plate girders
Flange plates frequently thicken at midspan.
Flange plates frequently thicken over piers and sometimes at midspan.
Bearings
Usually a single line of bearings at each pier.
Two bearings at intermediate piers.

Figure 1

simply supported and continuous spans. To ategorize a bridge just by its appearance is dif- icult; whenever possible, construction drawings hould be used. Because this is seldom practical, engineers must have a method to categorize bridge tructures rapidly. Some principles and construc- ion practices can help with this process.

Bending moment is the governing factor in most ridge designs. The construction depth generally in- reases at the location of maximum bending noment; the flange thickness may also increase on teel stringers at the point of maximum bending noment. According to the principles of material cience, the maximum bending moment on a simp- supported span occurs at the midpoint. The maxi- num bending moment for a continuous span occurs t the intermediate supports. By using this informa- ion, engineers in the field can categorize most spans into one of the three major categories. Figure 1 can be used as a guide in the categorization process.

About 94 percent of all bridges are either simply supported or continuous types. Miscellaneous bridges make up the remaining 6 percent of bridge types. Bridges in the miscellaneous category include suspension spans, swing-span and lift bridges, bascule bridges, vertical-lift bridges, and float bridges. The Sheffield method provides detailed demolition techniques for simply supported and continuous spans. Procedures to demolish miscellaneous bridges are discussed separately in FM 5-250.

As a rule, continuous spans are more difficult to destroy than simply supported spans and require a greater amount of explosives. When in doubt about the bridge type, assume it is continuous. This conservative approach will guarantee bridge demolition though not the most efficient use of explosives. After the bridge is categorized into one of the main categories, it is further classified by using the decision trees shown in FM 5-250, pages 4-10 and 4-15. Composite steel and concrete construction is classified according to the major longitudinal load-carrying members in the span. Once the span is fully categorized, engineers use the tables in Appendix H, FM 5-250, to decide the best method for destroying the bridge.

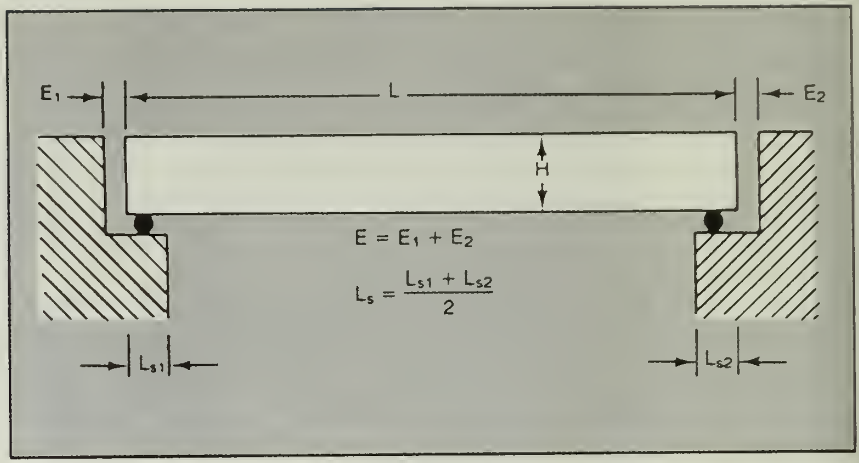


Figure 2

Simply Supported Spans

Simply supported spans are the easiest type of bridge to destroy. The recommended point of attack is always at the midspan to take advantage of the maximum bending moment generated by the bridge dead load. The line of attack should be made parallel to the face of the bridge abutments to reduce the possibility of twisting and jamming. To use the procedures in FM 5-250 for a simply supported span, four critical dimensions must be obtained: total bridge depth (H), span length (L), total end clearance (E), and average length of the bearing supports (L_s). (Figure 2.) The three attack methods for the simply supported bridge are the bottom, top, and angled attacks.

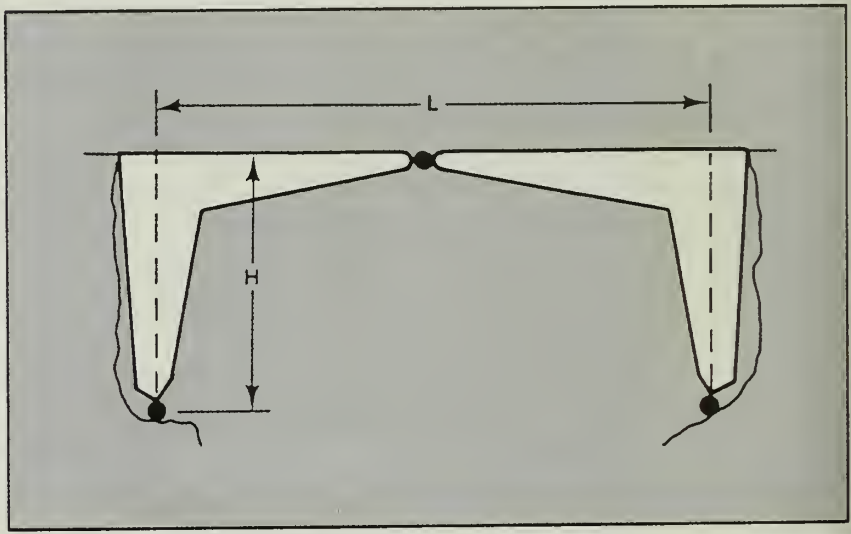


Figure 3

The bottom attack is the preferred method for destroying simply supported spans. It provides some cover and concealment for the demolition party and allows use of the bridge up to the point of demolition. It is particularly useful for bridges with steel stringers, where charges can be placed inside the channels of the steel members. Bottom attacks are generally not used on concrete beam or slab bridges because of the difficulty in attaching charges. Use of the Sheffield method allows engineer planners to calculate the minimum required end clearance (E_R) to prevent jamming when using a bottom attack. This value is compared with E to ensure jamming will not occur. If E is less than E_R, the unit must use a different attack method or blow one or both abutments to provide additional end clearance.

Top attacks are used primarily on concrete beam and slab bridges where a bottom attack is impractical. In the top attack, the Sheffield method enables the engineer planner to calculate the length of cut required (L_c) to prevent jamming.

The concrete-stripping charge is a new technique used to create the L_c for reinforced-concrete bridges. The charge cuts a ditch across the span and all the way through the depth of the bridge. The concrete-stripping charge destroys all of the minor reinforcing steel and damages most of the major reinforcing steel. The major reinforcing steel should fail in tension when the compressive concrete is removed. When using the concrete-stripping charge, the ditch width (W_d) is compared to the L_c to ensure that jamming will not occur. If necessary, the charge is increased to ensure that the necessary cut is obtained.

An angled attack may be used when end clearance is not a problem. When using the angled attack, all bridge members must be cut (span, hand rails, service pipes, and so forth). The point of attack is located between the midpoint and a point one-third the length from one end of the span. The cut is made at 70 degrees to the horizontal to prevent jamming.

Continuous Spans

Continuous spans generally are more difficult to destroy than simply supported spans because they have no common point of attack. The Sheffield method provides recommended attacks for each type of continuous span. The line of attack should still be made parallel to the face of the abutments to prevent twisting and jamming. The critical dimensions for planning the attack of a continuous span are L, which is measured from the centerline of the bearings, and the bridge rise (H), which is measured from the springing to the top of the deck. (Figure 3, page 30.)

Continuous steel and concrete bridges usually are attacked by cutting the span on both sides of the intermediate supports. The concrete-stripping charge used for simply supported concrete spans can also be used for continuous spans. The Sheffield method recommends locations for cuts that will create an unbalanced bending moment in the span. This bending moment will cause the span to collapse. Because of their design, continuous concrete spans often require two-staged attacks to ensure their complete destruction. The first attack destroys the concrete; the second attack removes the reinforcing steel. Therefore, continuous concrete bridges should not be used for planned reserved demolition targets.

Arch and portal bridges are attacked by calculating the minimum L_c required to ensure their destruction. Although the formulas for each type are different, the procedure is the same as for simply supported top attacks.

The Sheffield method of bridge demolition is the most significant change to U.S. Army demolition doctrine in the last 20 years. Now, for the first time, engineers can accurately calculate the minimum amount of explosives necessary to guarantee the complete destruction of most bridges. This will improve engineer support to the maneuver elements and better use the limited resources available on the battlefield.

Major Davis is the S3 of the 1st Engineer Brigade at Fort Leonard Wood, Missouri. He has served in the 54th Engineer Battalion and the 307th Engineer Battalion. Major Davis has a BS degree in civil engineering and is a graduate of Command and General Staff College.

(Lessons Learned, continued)

ISSUE: Many engineer units do not have contingency plans for natural disasters.

DISCUSSION: U.S. Army engineers will respond to many disasters. Whether fighting fires in the Rocky Mountains or quelling civil disturbances in inner cities, federal military forces will continue to serve the immediate needs of U.S. citizens and our allies when natural or man-made disasters occur. Some units, such as the 25th Infantry Division (Light), Fort Shafter, Hawaii, have disaster response as one of their contingency missions. Disaster relief is on their division mission essential task list (METL).

Contingency plans are valuable because they can speed up the deployment process, even though they may require some modification for any given disaster. Unit locality has no bearing on the type of disaster you may be assigned to deal with. Units from as far away as Fort Drum, New York, and Fort Riley, Kansas deployed to Florida in response to Hurricane Andrew. Air National Guard units from Alaska supported Operation Garden Isle in Hawaii.

RECOMMENDATION: CONUS-based contingency planning and rapid force projection have replaced our Army's forward deployment posture. Contingency planning for natural disasters is good practice and good training. In the absence of guidance from higher headquarters, engineer units should prepare contingency plans to support major disasters (fires, floods, tornados, hurricanes, earthquakes, and civil disturbances). Determine the equipment and material needs for each scenario, organization and manpower requirements, deployment sequencing, and your unit's sustainment needs. Prepare equipment load plans and checklists showing where to obtain critical equipment and materials. And, remember to evaluate your own intelligence needs that may drive the makeup of key personnel in the advance party.

Major Brannon is an analyst in the U.S. Army Engineer School. Previous assignments include platoon leader, DEH operations and executive officer, assistant S3, and company commander. He is a registered professional engineer in Texas.

Deploying from Two Places at Once:

A Challenging Experience

By Captain Paul J. Karnaze

The 937th Engineer Group is an active Army engineer group at Fort Riley, Kansas. The group consists of a headquarters company, the 34th Engineer Battalion, 541st Maintenance Battalion, and the 16th Mobile Army Surgical Hospital. The 937th Group was called to assist in the disaster relief effort from Hurricane Andrew. However, Colonel Greenwalt and the tactical command post were at Fort Leonard Wood, Missouri, participating in a field exercise with the 5th Engineer Battalion. Responding to the relief effort meant deploying the 937th from two locations within 66 hours. This article describes how this took place.

Just when you think you've covered all the bases, they slide in a curve ball that messes up the whole game plan. Actually, I felt like I did not even know what game I was playing when I returned from leave late on the night of September 1. It was about 2230 when my wife and I walked through the door, tired from our flight, to find a message on the answering machine. My assistant S4, the group staff duty officer, had left a message that something was up. He did not say much except that we had an 0300 staff planning session at headquarters with the group executive officer. At first I thought that it was a welcome home joke by my lieutenant, but then I detected a serious tone in his voice that told me this was no pun. I decided to call him at the duty phone number and

At Fort Riley

0200300S September 1992: The warning order was out. We did not know exactly when the execution order would come or when we would leave, but we now had a mission—participate in Task Force Wright to provide command and control for debris cleanup operations in south Florida. Quite a mouthful, but what did it mean? Questions began to surface:

- Who will go—group headquarters, the 34th Engineer Battalion, or both?
- What are our critical personnel shortages?
- Who will conduct the prepare for overseas movement (POM) order and when?
- What are our critical equipment shortages?
- What mission or region-specific items might be required (additional haul assets, Class IV, maps of south Florida, additional communications equipment, assorted batteries, SSSC supplies, mosquito nets, bug spray, 2-quart canteens, and work gloves)?
- What about Colonel Greenwalt, Group Commander, and the tactical command post (TAC)? The TAC provides command and control for engineer-specific missions that group elements conduct in forward locations. It also can be the advance party for the group. TAC equipment includes a built-up HMMWV

Soldiers and equipment board a C-5 at Forbes Air Field en route to Homestead AFB. Limited time required the equipment to be moved by air rather than by rail. (Photo by SFC W. Fleming.)

connected to a 577 tent extension with communications and work areas, three HMMWVs for command and control, and a diesel generator. The crew consists of the S2, S3, S3 operations officer, S3 construction officer, S3 staff NCO, communications NCO, mechanic, and four driver/RTO/ clerks.

We scheduled a video teleconferance for 0400 to discuss the mission with Colonel Greenwalt.

At Fort Leonard Wood

The commander and the TAC had a little more information about the mission—they had received a hard copy deployment order from FORSCOM around midnight. Because of the immediate needs in Florida, the group would deploy within days, not weeks or months, after notification. Therefore, the TAC would deploy from Fort Leonard Wood to Homestead Air Force Base, Florida. Once there, the TAC would coordinate with on-site higher and subordinate units and secure an area for the main body from Fort Riley.

The video teleconference answered many of our questions:

- The mission was expected to last from 30 to 60 days.
- The TAC would deploy by C-130s from Fort Leonard Wood to Homestead AFB.
- The group's main body would deploy by buses and transport trucks to Forbes Air Field, Topeka, Kansas, and then by C-5s to Homestead AFB.
- Ordering officers and Class A agents, who would buy mission-essential supplies locally, had to be certified.
- Additional communications assets would be acquired to replace those the 1st Infantry Division units had borrowed for REFORGER.
- Division G1 would assist in filling equipment and personnel shortages within the group.
- All group headquarters' commitments through October would be cancelled.
- Personnel would take weapons and ammunition basic loads.
- Each person would take a five-day supply of meals ready to eat (MREs).

The remaining question was, how would the TAC deploy and who would support them?

The 5th Engineer Battalion went overboard helping the TAC deploy. They provided work space, airload specialists, transportation support, and issued MSE equipment. By 0600 on September 2, the TAC crew was preparing the vehicles and equipment for the airlift. By 0700, the 5th Engineer's communications specialists had installed mobile subscriber radio and telephone equipment in two vehicles. The vehicles then went to the wash rack, where DOL personnel helped prepare them for airlift. Meanwhile, TAC personnel coordinated with 5th Engineers for equipment and supplies. By 1230, the HMMWVs were cleaned, loaded, and prepared for boarding. The only item left was to complete the Hazardous Cargo Clearance and Air-Load

Movement Plan by 1400. At 1430, the vehicles were weighed and loaded; the first C-130 departed Fort Leonard Wood at 1500, and the second one left about two hours later.

Back at Fort Riley

The group's main body began to prepare for movement. After the video teleconference, the executive officer briefed company personnel while the staff published a modified packing list, identified nondeployable personnel, coordinated to fill personnel and equipment shortages, acquired Class IV for blocking and bracing, and prepared personal gear. We had no air-load movement plans on file, so the new unit movement officer created the data.

On September 3, the installation POM team conducted a POM in the morning followed by vehicle load-out in the afternoon. However, neither aircraft schedules nor departure times had been established by late afternoon. At 1430, the emergency operations center (EOC) informed the group that they would not depart until September 7 or 8. Thus soldiers were preparing to go home when a message arrived from FORSCOM (about 2000) stating that they would fly from Forbes Field the next morning. The unit prepared for air movement throughout the night, securing the vehicle loads, performing preliminary airlift inspections, and staging and loading vehicles onto transporters for movement.

September 4 began with formation at 0430 to draw weapons and protective masks, verify airlift manifest information, and release soldiers for breakfast. At 0600, the unit departed Fort Riley for Forbes Field. The UMO and the unit completed all paperwork and loaded the first C-5, which departed Forbes Field at 1400, about 66 hours after notification. The second aircraft was delayed 24 hours because of mechanical problems. Most of the personnel deployed on the first aircraft, leaving the UMO and a skeleton crew to deploy on the second aircraft. The total count was 82 soldiers, 12 HMMWVs, 9 HMMWV trailers, four 5-ton cargos, one 5-ton cargo trailer, 4 small CONNEXs, and a headquarters-worth of equipment and tents, which were deployed by two C-130s and two C-5s.

Lessons Learned

A deployment that requires movement from two locations by the same unit produces many lessons learned. Some of them are positive affirmations that plans on paper work, while others prove that what is on paper does not always pan out.

- Be flexible. The Son of FRED (Fort Riley Emergency Deployment Support Plan, revised) is a good guideline, but it is unrealistic when given less than the recommended 15 days to deploy.
- Develop air-load as well as rail-load movement plans ahead of time, and keep them in movement books. Existing plans can be modified quicker than new ones can be created.
- Establish and train movement teams to alleviate delays and coordination problems.
- Use an external unit's motor pool personnel to prepare the departing unit's vehicles for movement. These personnel can perform maintenance and on-the-spot repairs, weigh and steam-clean vehicles, and assist in departure airfield control group (DAG) operations. This gives the deploying maintenance personnel time to pack tools, manuals, equipment, and repair parts.
- Create a list of movement preparation items. These items are not necessarily MTOE authorized but are essential to efficiently prepare the unit for movement. Include petroleum down-loading pumps, lifting shackles, outside lighting, and blocking and bracing materials.
- Assign external personnel as ordering officers and Class A agents. These become full-time jobs when associated with engineer units because of the great variety and quantity of items, especially Class IV, that must be purchased locally to perform construction missions. Staff members are busy with their primary functions and may not have time to purchase items locally. Using external personnel also eliminates any conflict of interest problems that could be perceived.

It is inspiring to see a unit respond to the unexpected and succeed. Everything does not always happen according to plan. Our group never anticipated an order to deploy in 66 hours from two separate locations. However, when a unit practices what it plans, change is not necessarily disastrous. This would not be the last change to occur on the deployment. The warm-up was over, and now it was time to play ball.

Captain Paul Karnaze is the S4 for the 937th Engineer Group, Fort Riley, Kansas. He received an ROTC commission and a bachelor of science degree from the University of Kansas. He is also a graduate of the Infantry Officer Basic Course and the Quartermaster Officer Advance Course. Previous assignments include positions in the HHC, Berlin Brigade and the 5/502d Infantry Parachute Regiment.

Engineer Solution

SOLUTION:

The Sheffield method is the preferred method of bridge demolition. An introduction to this method is provided in the article, "The Sheffield Method of Bridge Demolition", beginning on page 28.

Step 1. Recon and categorize the bridge as a simply supported, concrete beam slab with bottom support.

Step 2. Obtain the following critical dimensions:

$L = 15m$

$H = 1.4m$

$E = E_1 + E_2 = 0.1 + 0.1 = 0.2m$

$$L_s = \frac{L_{s1} + L_{s2}}{2} = \frac{1.5 + 1.5}{2} = 1.5m$$

Step 3. Determine a method of attack from Table H-3 (Attacks on Simply Supported Bridges), FM 5-250.

Use Serial 20, Deck Bridge, Bottom Support Method III. A top attack is appropriate. Cut at midspan with a concrete-stripping charge.

Note: Serials 18 and 19 are for use only on slabs.

Step 4. *Calculate the minimum length of cut (L_c)* to prevent jamming in the top attack:

$$H/L = \frac{1.4}{15} = 0.093$$ (round up to 0.10 for Table H-2, FM 5-250)

$$L_s/L = \frac{1.5}{15} = 0.10$$

$L_c/L = 0.150$ (from Table H-2, FM 5-250)

$L_c = (L_c/L)(L) = (0.150)(15) = 2.25m$

Engineer Solution

Step 5. *Compare the ditch width (W_d)* from the concrete-stripping charge with the required L_c:

W_d = 2h + 0.3
h = overall roadway and beam/slab depth
$W_d = 2(1.4) + 0.3 = 3.1m > L_c = 2.25m$

Therefore, one row of charges is sufficient.

Step 6. Calculate the amount of explosives required for the concrete-stripping charge.

Beams

$P = 3.3\,(3.3h + 0.5)^3$ (pounds of TNT per meter)

$P = 3.3\,[(3.3)\,(1.4) + 0.5]^3 = 442.9$ pounds of TNT per meter

Amount per beam = (pounds of TNT per meter) (beam width)

= (442.9) (0.5) = 221.5 pounds of TNT per beam

Determine the equivalent amount of C4 required per beam (divide by the RE factor).

$\frac{221.5}{1.34} = 165.3$ pounds of C4 per beam

Determine the number of packages of C4 required per beam.

$$N = \frac{\text{Charge weight}}{\text{Package weight}} = \frac{165.3}{1.25} = 132.2$$

Round up to 133 packages per beam.

Slabs

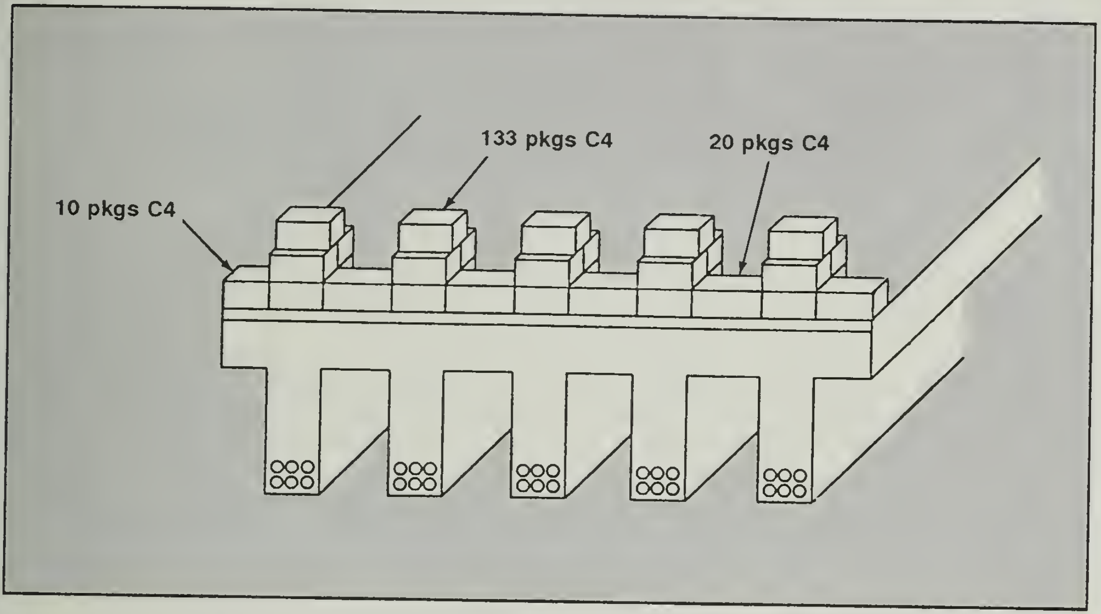
$P = 3.3\,(3.3h + 0.5)^3$ (pounds of TNT per meter)

$P = 3.3\,[(3.3)\,(0.5) + 0.5]^3 = 32.8$ pounds of TNT per meter

Amount per slab = (pounds of TNT per meter) (slab width)

= (32.8) (1.0) = 32.8 pounds of TNT per slab

Engineer Solution



Determine the equivalent amount of C4 required per slab (divide by the RE factor).

$$\frac{32.8}{1.34} = 24.5 \text{ pounds of C4 per slab}$$

Determine the number of packages of C4 required per slab.

$$N = \frac{\text{Charge weight}}{\text{Package weight}} = \frac{24.5}{1.25} = 19.6$$

Round up to 20 packages per slab.

Total charge equals the (number of beams) (packages per beam) + (number of slabs) (packages per slab)

$$P = 5(133) + 5(20) = 765 \text{ packages of C4 per slab.}$$

Note: To reduce the amount of explosives required by one-third, tamp each pound of explosives with two filled sandbags.

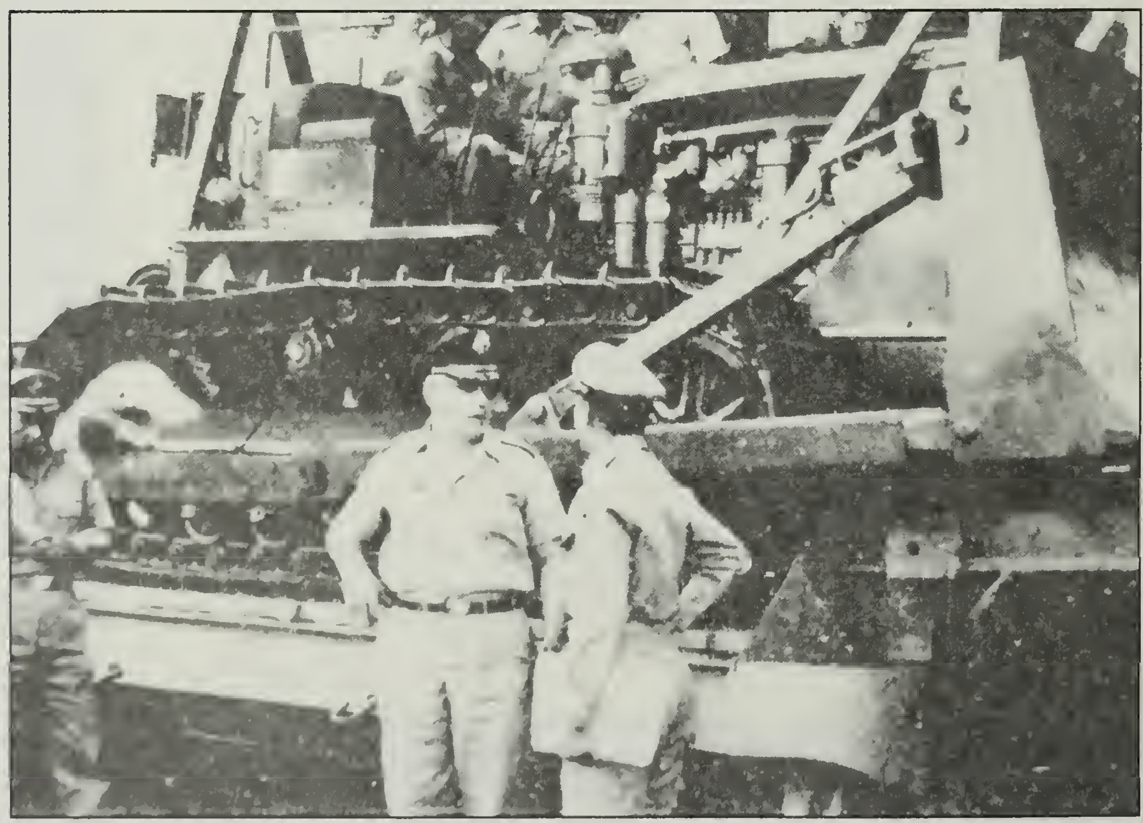
This ENGINEER Problem/Solution was submitted by Major Ira Joe Davis. Currently the S3 for the 1st Engineer Brigade, Fort Leonard Wood, Major Davis formerly served as chief, Combat Engineering Division, Department of Instruction, U.S. Army Engineer School.

Philippine Engineers in Nation Assistance: The Huk Campaign

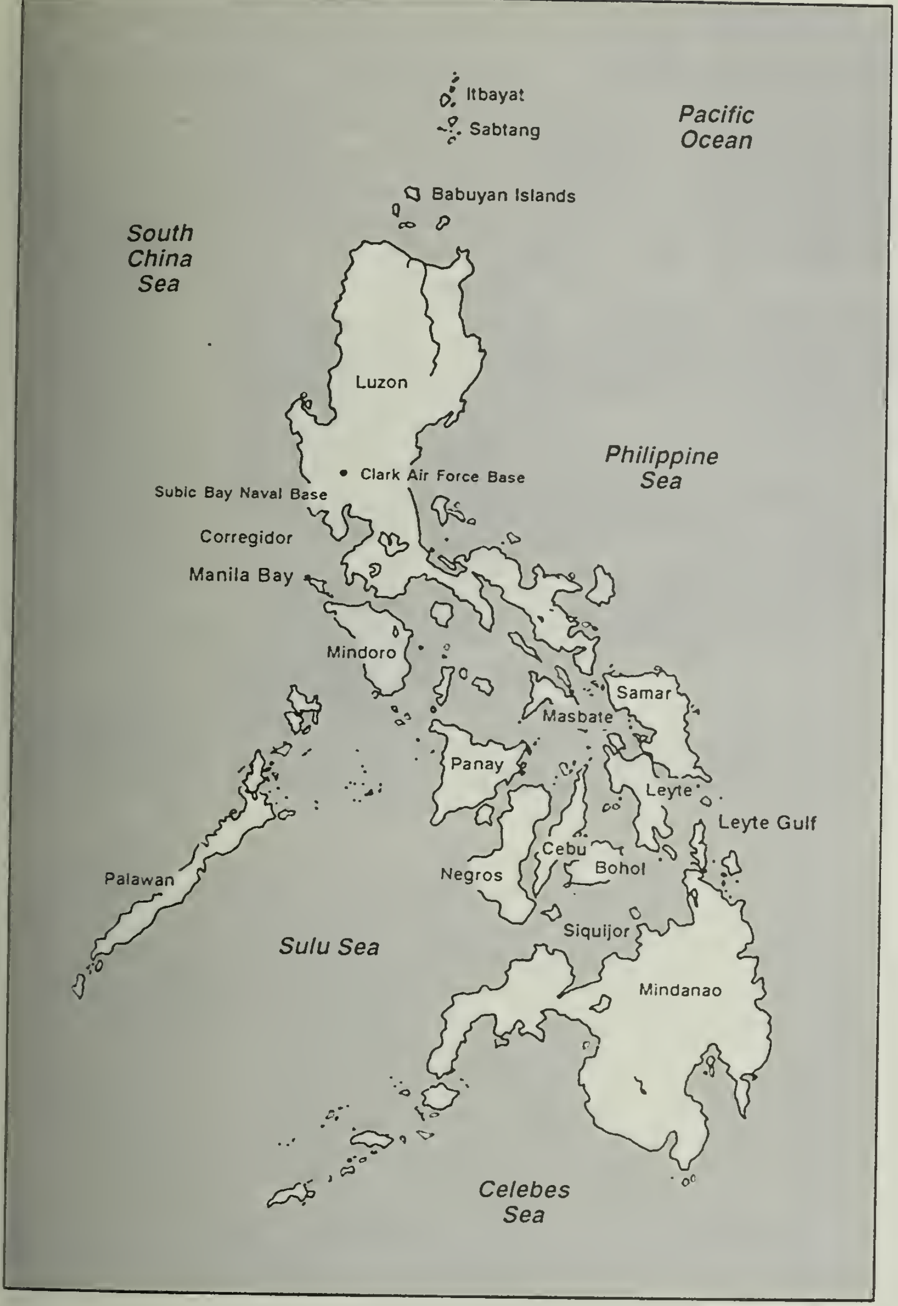
By Captain James R. Weber

To effectively combat a counterinsurgency, a country must coordinate political, psychological, social, economic, and military factors. The engineers of the Armed Forces of the Philippines (AFP) played a significant role in the successful campaign against the communist guerrillas, known as the Hukbong Mapagpalaya ng Bayan (Huks) or People's Liberation Army, in the late 1940s and 1950s. Because of policy changes in the political arena, the government and the army lost significant support from the people. When the administration turned its efforts to rebuilding the country by using the army engineers, the people's perception of the government and the army improved. Some of the AFP's missions, which included upgrading roads, building bridges, constructing schoolhouses, and drilling wells, helped improve their image.

To counteract the communist influence, the U.S. limited its role in nation assistance to technical expertise and monetary aid. The U.S. gave the Philippines $250 million in economic aid over a five-year period, and the U.S. Army sent a Joint United States Military Advisory Group (JUSMAG) to provide technical assistance. Although American engineer units did not participate in the civic action missions after 1946, engineer officers continued to serve on the JUSMAG staff.



U.S. Army MG Daniel, Chief of JUSMAG, and LTG Cruz, Chief of Staff of the AFP, confer about engineer equipment. (Photos courtesy Alvin H. Scaff, *The Philippine Answer to Communism*, Stanford University Press.)



The Philippines

Background

After the Japanese invaded the Philippines in March 1942, the Communist Party of the Philippines (CPP) formed the Hukbalahap (People's Army Against the Japanese) or the Huks. By fighting the Japanese, the Huks won support for the communist cause from the Filipino people and remained an influential organization after the war ended. It was then that the CPP changed the name of their military branch to the People's Liberation Army.

In July 1946, when the Philippines gained their independence from the United States, the Huks began a terrorist campaign to seize control of the newly formed republic. The Philippine President, Manuel Roxas, developed a policy of all-out force to eliminate the Huks. When the army and the Philippine constabulary indiscriminantly shelled villages that they suspected to be Huk strongholds, support turned away from the government and toward the Huks.

Elpidio Quirino became president in 1948. He changed the brute-force policy to one of conciliation by trying to collect weapons from the Huks and granting them amnesty. After a few months, Quirino's conciliatory policies failed, and the Huks continued to consolidate their power.

In 1950, the Huks staged large-scale raids to show how weak the government was. In response, the administration returned to the brute-force policy, which again proved to be unsuccessful. For example, when the constabulary killed innocent civilians at Maliwalu, Pampanga, the people condemned this action. An officer wrote that people supported the Huks simply because soldiers abused innocent people. Because of such actions and mistakes made by the government, the Huks gained control over large parts of the country.

Policy Shift

In September 1950, Ramon Magsaysay assumed the duties of Secretary of the Department of National Defense. Magsaysay implemented many needed reforms within the armed forces and was instrumental in altering the government's approach toward the Huks. The government had learned two important lessons regarding the Huks: it needed the respect and cooperation of the people, and the people might support the government if it dealt with the Huks in a just and humane way.

Magsaysay was the driving force behind the shift in the administration's policy. He developed a two-fold approach to the counterinsurgency: army battalion combat teams would conduct small unit raids against the Huks, and the army would perform civic action missions. To accomplish the civic action missions, army engineers staffed the Economic Development Corps (EDCOR) to build farm settlements, freshwater wells, road networks,

Engineers of the AFP clearing thick jungle for a road.

bridges, and schools. Creating EDCOR was an important development in the counterinsurgency.

Farm Settlements. Many Filipinos were tenant farmers who did not own their land. The communists demanded land for the landless. Through EDCOR, Magsaysay offered the Huks and other peasants 25 acres of land and a government-built house. Not surprisingly, the people looked favorably on this program. The country had plenty of jungle land; the problem was how to make the jungle usable for agriculture. Magsaysay turned to the army for an answer to this dilemma. The Engineer Service Battalion (Composite) was tasked to transfer the land into crop-producing areas. In February 1951, EDCOR opened 75,000 acres of land for settlement.

The most important benefit from the EDCOR settlement program was the public's perception of the government. Even though fewer than 300 former Huk families and 1,000 total families received farmland from the government, Magsaysay scored a moral victory. He publicized this initiative and showed that he could provide land for the landless faster than the Huks could. Through EDCOR, Magsaysay converted some of the die-hard communists and gained support from the general population toward the government. The EDCOR farms were an immediate display of government reform, and peasants began to believe that the administration actually cared for their welfare.

The Huks retaliated. In April 1953, three officers and two enlisted men from the Philippine Corps of Engineers were en route to inspect a site designated for an EDCOR farm when Huks ambushed and killed them. The government honored the slain engineer officers by naming farms after them: the new project was named for Captain Paredo, and the existing ones were named for Major Arevalo and Lieutenant Gallego.

Liberty Wells. Army engineers assisted in a well-drilling program because many rural communities did not have a good supply of drinking water. They drilled as many as 60 artesian wells in one 45-day time period. This liberty well project was so important to the Filipinos that they established a Liberty Wells Association. Their slogan was a Chinese proverb that said, "God bless those who dig wells, build bridges, and construct roads." This work continued to enhance the people's confidence in the army and the Philippine government.

Road Networks. Before World War Two, the Philippines had a fairly good road network. Numerous roads and bridges were damaged during the war because of the fighting between the allies and the Japanese. While American engineers repaired the transportation system enough to support their own offensive to retake the islands, they did not restore all of the roads. The poor road conditions benefited the Huks because foot travel was more feasible than vehicular travel. They moved around on foot, making it difficult for the government to track them.

The people blamed the government for the poor roads. Again, the government turned to the engineers for help. From 1946 to 1952, they repaired 263 bridges and 385 miles of roadway, making all the roads that existed before the war operational. Besides repairing existing roads, the engineers built new ones. When Magsaysay was President of the Republic of the Philippines, he emphasized the construction of secondary roads. These feeder roads helped villages that once were considered remote. Farmers then were able to trade their goods and deliver their crops easier than when they traveled on footpaths through dense vegetation. By restoring and constructing the road network, the Philippine people were able to see their government at work for them.

Schoolhouses. In 1954, President Magsaysay enacted a program to build schoolhouses throughout underdeveloped areas of the country. The 1st Engineer Construction Group, which was formed in February 1954, manufactured and erected about 500 prefabricated schoolhouses in one year. To help the schoolhouse program, the army organized an Engineer Forestry Company to produce lumber.

Operation Redemption. The government continued its positive influence through another initiative, Operation Redemption, which started on January 7, 1954, as a symbol of commitment to support the peasants. This time the army targeted the deserted hamlet of Luis Taruc, the Huk leader. To improve living conditions, 3,000 army engineers and trainees cleaned up the area, built roads, and dug wells. The project was successful, and within one year, more than 2,000 Filipinos inhabited the town.

The End of Hostilities

By 1954, when large-scale fighting between the government and the Huks ended, the army had captured and killed many Huk leaders. The People's Liberation Army Committees disbanded, and Luis Taruc surrendered in May 1954.

The government was victorious for several reasons: the highly mobile battalion combat teams attacked the Huks incessantly, the government received intelligence information from its growing public supporters on the location of the Huks, and Magsaysay used the army in a socioeconomic role as well as in its military role.

n EDCOR settlement built by engineers.

Expanded Civic Action

The engineers continued to be involved in civic action programs after the fighting ended. With a decreased military threat, the army started transferring soldiers from the infantry battalion combat teams to the engineers. Consequently, the 1st Engineer Construction Group increased its personnel strength. Government leaders continued to emphasize socioeconomic programs because they realized that many of the conditions that contributed to the spread of the communist movement still existed. Continuing the programs meant involving the engineers.

As a result of this involvement, the army organized additional engineer units to work on rural development programs. In January 1956, the 1st Engineer Combat Group was formed, which consisted of 1st, 2nd, and 3rd Engineer Combat Battalions. This unit was designated as a combat engineer group, but its main function was to help the 1st Engineer Construction Group complete civic action projects. For example, the 2nd Engineer Combat Battalion constructed the 9-kilometer Agoncillo-Bosoboso-Gulod road in Batangas, which mainly consisted of feeder roads. The 3rd Engineer Combat Battalion built many roads, bridges, and prefabricated school buildings in central and northern Luzon.

These types of civic action projects continued into the late 1950s. The government's plan for land reform produced positive results. The EDCOR program expanded and more peasants obtained their own land to farm. The original civic-action programs of the feeder roads, liberty wells, and prefabricated schoolhouses continued to have a high priority because they provided essential services to an increasing number of people.

Conclusion

Under Magsaysay's leadership as Secretary of National Defense, the Philippine army proved that they could effectively accomplish tasks outside the normal military realm. As president, Magsaysay orchestrated all government agencies to address each element of counterinsurgency. Specifically, the Philippine engineers helped to rebuild the country and combat the Huks. They helped in rural development programs, improved the peasants' quality of life, and contributed to the successful execution of the counterinsurgency. The Philippine government began land reform and funded many projects with grants and loans with the economic aid the U.S. provided. However, the Corps of Engineers of the Philippines Armed Forces deserves much of the credit for the success of the civic action programs.

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ENGINEER UPDATE

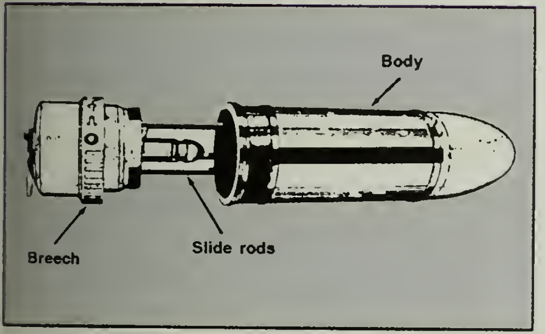
Commercial numbers are (314) 563-XXXX and Defense System Network (DSN) numbers are 676-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

1993 Senior Engineer Leaders Training Conference (SELTC). The 1993 SELTC for Active and Reserve Component senior leaders will be held on April 20-24 at the Engineer Center. A District Commanders Conference and SELTC activities will be held concurrently on April 21-23, with registration beginning on April 20. The Regimental Dinner is scheduled for April 23. Invitations will be mailed early in February. POC is CPT Steve Chi, -5335.

ENGINEER Readership Survey. Thanks are extended to those readers who responded to *ENGINEER's* survey. Responses will be used to improve the content and quality of future issues. Many units indicated that we have an incorrect address on file or that they do not receive the number of copies required. To fix those deficiencies, send your old and new addresses and the number of copies required to: Engineer Professional Bulletin, Attn: ATSE-TDM-PB, Fort Leonard Wood, MO 65473-6650. POC is Jennifer Bolyard, -7644.

Cartridge, Subcaliber Ammunition Training Device (M970). Fielding of the M970 training device for the Combat Engineer Vehicle (CEV) will resume in February 1993. Units in Germany will receive the M970 training device in February. Korea and CONUS units will begin receiving the device in March. Devices to the remaining engineer units in CONUS will be fielded through September 1993. The fielding plan for February and March is shown below.



CEV M970

Engineer Units	Location
February 93	
58th CO	Baumholder, GE
16th BN	Fuerth, GE
40th BN	Baumholder GE
12th BN	Bad Kreuznach, GE
10th BN	Wuerzburg, GE
82nd BN	Bamberg, GE
23rd BN	Hanau, GE
March 93	
2nd BN	CP Castle, Korea
44th BN	Kimpo, Korea
97th BN	Fort Irwin, CA
129th BN	St. Anthony, ID
286th BN	Bellingham, WA
132nd BN	Sacramento, CA
NTC Blue Force	Fort Irwin, CA

The M970 device is a simple-to-use trainer that does not require any new equipment team training or spare parts. Units are authorized to use the device upon receipt. POC is Bill Good, -7637.

Bailey Bridge Video Tapes. Two new video tapes, Bailey Bridge Construction, Parts I and II, are available in TASC film libraries Army-wide. Bailey Bridge Construction, Part I, TVT 5-30, describes bridge site preparation from reconnaissance to completion of the site layout. Construction of a Bailey bridge is described in Part II, TVT 5-31. It describes the complete construction of a 100-foot double-single Bailey bridge with an upgrade to double-double capacity. POC is Dave Shafer, -7749.

Directorate of Combat Developments (DCD)

AN/PSS-12 Mine Detector. Production tests have identified a defect in all AN/PSS-12 mine detectors. Investigation revealed that the bracket on the search head where the telescopic pole attaches is cracked or broken. This defect does not render the unit inoperable. The detector can be used until repair procedures become available. All defective sets should be retained until disposition instructions are received from ATCOM. POC is SFC Michael Craig, -7993.

Concept Evaluation Program (CEP). The CEP is a Training and Doctrine Command (TRADOC) program that provides quick, innovative testing to resolve training and combat development issues. Proponents such as the Engineer School use the program to refine materiel requirements or determine the operational and training potential of new materiel. It is used to assess the potential for adapting commercially available items or modifying existing items and prototypes to satisfy user requirements. The program is also used to evaluate nonmaterial applications, such as testing of doctrine, training and organizations. Ideas for potential candidates for CEP can be submitted to: Commandant, USAES, Attn: ATSE-CDM, Fort Leonard Wood, MO 65473. POC is Dr. Merrill Stevens, -7500

Directorate of Evaluation and Standardization (DOES)

Special Studies. Input from engineer units is requested to support two special studies conducted recently at the Engineer Center. Both studies concerned the quality of training soldiers receive—one involved the physical fitness of graduates; the other reviewed the adequacy of maintenance training. Send comments or suggestions to improve the training (in these or other areas) of soldiers you receive from the Engineer Center to: USAES, Attn: ATSE-ESE, Fort Leonard Wood, MO 65473. POC is Jerry Wauthier, -5297.

Reserve Component (RC)

Reserve Training Office. We welcomed Major Joe Aldridge, Chief of Reserve Training, in November 1992. He is the point of contact for Reserve Component configured courseware (RC^3) products. Questions may be addressed to: Commander, USAES, Attn: ATSE-TD-TDR, Fort Leonard Wood, MO 65473. MAJ Aldridge may be reached at -7522.

BRIDGE THE GAP

By Command Sergeant Major Roy L. Burns, Jr.
U.S. Army Engineer School

I write this as I finish my first week serving you as the Engineer Center Command Sergeant Major (ECCSM). I'm filled with excitement, enthusiasm, anxiety, and anticipation. And, I'm more than a little humbled by the honor bestowed on me, as well as the responsibilities that lay ahead of me.

As I was leaving Germany, a soldier asked, "Sergeant Major, aren't you scared by all this?" I couldn't help but think about what General George S. Patton, Jr., said: "All men are a little frightened..." A little frightened? Yes, but I'm optimistic that we have a great team that is able to take on challenging missions and win! Decisive victories are our legacy. Ensuring future successes is our challenge. So, let me introduce myself, share some of my goals with you, and discuss the kind of leadership we need to nurture.

I am 39 years old and have 20 years of active duty. I served three tours in Germany. My leadership style is making soldiers feel confident that they can approach me anytime, anywhere, about anything. The contributing factor for attaining my position as the ECCSM is SOLDIERS! The soldiers I've been responsible for, directly or indirectly, did what I asked. At the same time, my commanders believed in my ability to accomplish the mission. I am a stickler for leading by example. My favorite quote, which I use and teach others is, "In order to be successful in anything you want to do, you must have a goal."

I have three goals to accomplish at the Engineer Center:

- Establish two-way communications from the Engineer Center to units in the field.
- Ensure that the quality training taught here is tough, realistic and, above all, safe.
- Continue to promote quality-of-life issues for single soldiers and families on Fort Leonard Wood.

The kind of leadership we noncommissioned officers need to nurture is genuine concern for new soldiers. For some of them coming into the Army, the future seems uncertain. As leaders we face many challenges: changes in Europe, changes in force size and structure, budget reductions, MOS consolidations, and the retention of quality soldiers. New soldiers are concerned about whether their leaders really "care about me and my situation." If we do uncaring things to soldiers during their first days in a unit, i.e. brush them off because we leaders are "busy," leave them out of major training events, or let them wait for days to in-process, they will only remember the "bad" things. Those memories can harm their integration into a unit.

When we say, "Leaders care for their soldiers," we mean they are genuinely concerned about the problems soldiers face from day one! Leaders care "bone deep" not just "skin deep." When a soldier has a personal problem, the caring leader strives to assist in dealing with the problem head-on, whether the problem occurs during the soldier's reception or during reassignment to a unit. The leadership counseling manual, FM 22-101, helps leaders develop the necessary skills to assist soldiers with their personal and professional growth.

Leaders must understand their soldiers in order to identify their problems and to assist as they strive for excellence. Leaders nurture their soldiers so they understand the rules, both formal and informal. For example, how to meet appearance standards, how to feel proud about what they do and the unit they belong to, and when to shout their motto when saluting—such as, "Hoo-ah, sir, Essayons!"

Belonging to a team is important to both soldiers and their leaders. As we spend time with our soldiers in different activities, let's make them feel they're important. Make them feel they are an integral part of the unit, and help them become functioning and important members of our unit—our team!

Firm and caring leadership creates a climate in which soldiers become motivated, enthusiastic, and willing to perform any mission. Soldiers always respond well to a leader who listens to their concerns, provides advice and assistance, and deals with them honestly and fairly. A positive climate develops through a sincere and continuous effort over time, not just during scheduled counseling to meet a requirement.

I challenge you to set goals and look forward with pleasure to working with you to accomplish them.

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ALCAN HIGHWAY 1942

On October 24, 1942, after only 8 months and 12 days of round-the-clock construction efforts, engineers working from both the north and south met at Beaver Creek, a few miles east of the Alaska-Canada border. During this remarkable construction project, 11,000 soldiers and 6,000 civilians from both the U.S. and Canada built the 1,523 mile-long highway known as the Alaska-Canada Highway, nicknamed the ALCAN.

Photo and art courtesy of Don Menzies *The Alaska Highway* The Douglas Printing Co LTD, Edmonton Alberta, Canada

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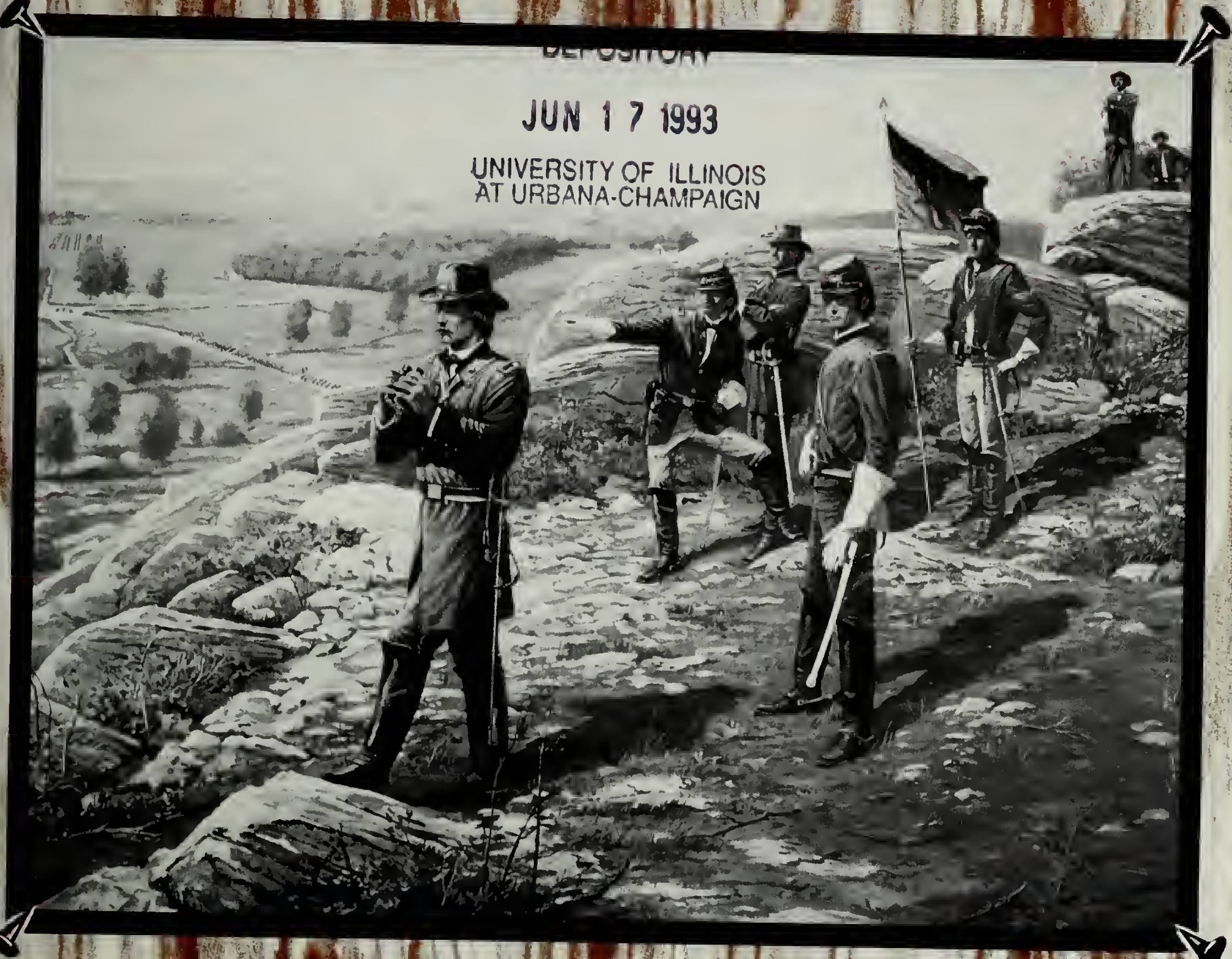

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Turning Point

PB 5-93-2

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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

Greetings from the Ozarks! Since my last chat, I've had the chance to visit and speak with our great engineer soldiers at Fort Ord, Fort Stewart, and the National Training Center at Fort Irwin. From these visits, it is clear that engineers are providing *outstanding* support to the total force; we consistently provide exceptional products in every arena, in every theater, during every exercise or contingency. However, many I spoke with, from young soldiers to senior leaders, were anxious about the future of the Army and concerned for our profession as engineers.

Although these fears and concerns cannot be totally eradicated, let me ease them a bit by explaining what I see for the future. The Army will continue to downsize—President Clinton has made that perfectly clear. Exactly how much of a cut we will take is still uncertain. Rest assured that we have done everything possible to minimize the impact of these reductions for the Corps of Engineers. Regardless of the details of our new military strategy, engineers must and will remain a vital member of the combined arms team. Our unique capabilities and professionalism, as showcased so vividly in recent crisis deployments, *assures* engineers of a key role in the Army structure of the 90s and beyond.

Let me explain. For our combat engineers, the notion of an engineer battalion aligned with a maneuver brigade is a clear winner. The Engineer Restructure Initiative (ERI) will continue but will evolve as our leaders rethink the role of heavy divisions. Further, for our combat heavy units, the requirement for both a tailored and responsive sustainment engineering force is critical to the concept of a "power projection" Army. In the operations other than war (OOTW) arena, engineers have consistently proven their capabilities throughout history; I am convinced this mission area will play an even more important role for the entire Army.

The civil side of the Corps is restructuring, with a decrease in overall assets. This streamlining was necessary to meet future challenges and should not greatly reduce their capabilities. (See the article by Lieutenant Colonel Norwood, page 16.) If President Clinton's plan to spend $300 billion on infrastructure is approved, Corps offices will have plenty of work. The Corps of Engineers will have another opportunity to maintain their reputation as the most dynamic engineer organization of its type in the world.

We must reassure our soldiers, civilians, and families about these expected changes. I need your help to get this word out! If we continue to let an "undercurrent" affect the way we do business, we will miss an outstanding opportunity to shape the future of our branch. The best way for us to ensure our future is to continue to demonstrate our unique capabilities. We must continue to demonstrate competence in all we do and be proactive rather than reactive to the changing environment. We must convince everyone, including maneuver commanders, of the validity of the ERI concept at every opportunity, and provide exceptional, not merely adequate, support. We must expand our role in the OOTW arena and continue to provide superb products, whether this be topographic support for a ravaged homeland, a bridge to aid a starving population, or an airfield to enhance contingency operations.

To ensure this type of continued performance, each of us must do our part. Training must continue to be innovative, dynamic, and cost effective. Professional development must be provided and monitored at all levels. Mentoring must be continued down to the lowest levels if we are to provide the outstanding support expected of us in the 21st century.

Changes are inevitable. Our legacy must be the efficient and effective management of these changes to ensure outstanding engineer support well into the 21st century. Tough times require strong, visionary leaders. Each of us must do our part in this process while adhering to the adage "Mission first, people always." I am convinced that the future Army and our Corps will survive this process and will continue to offer exciting, challenging, and rewarding careers. Join me in ensuring that every soldier is given an opportunity to excel in every circumstance, under any condition. Essayons!

Engineer

April 1993 Headquarters, Department of the Army ***Volume 23 PB 5-93-2***

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Cover: *Turning point, then and now. Just as Brigadier General Warren grasped the importance of key terrain on the outcome of the battle at Gettysburg, today's engineers are more important than ever in helping commanders see the battlefield (Painting by Dale Gallon).*

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Advances in Mine Warfare: An Overview

By William C. Schneck, Malcolm H. Visser, and Stuart Leigh

The tremendous worldwide proliferation of land mines, both simple and advanced, has increased the need for additional Army training and improved countermine technology. The increased use of land mines threatens to neutralize U.S. advantages in firepower and mobility by severely limiting the ability of maneuver forces to advance and support one another. Easily mass produced and inexpensive, mines will likely be encountered in any conflict, regardless of the enemy. In some cases, mines will be *the* major threat to U.S. forces. As with chemical weapons, they are a harsh reality of modern warfare. Army units must train to counter them as thoroughly as they now prepare for operations in a nuclear, biological, and chemical (NBC) environment.

This article, the first in a series of three, discusses the seriousness of the mine threat and what combat engineers can do to counter it. Articles in future issues of *ENGINEER* will describe the types of land mines that U.S. forces may encounter wherever they are called to fight.

The Threat

World threats are changing. The collapse of communism has reduced the short-term risk of global, conventional war. In addition, the convincing battlefield victory by the U.S.-led coalition in Operation Desert Storm served notice to potential aggressors that the United States remains vigilant in its role as the principal guarantor of world stability. The current geopolitical situation indicates that the probability of American forces engaging in a mid- or high-intensity conflict over the next few years is low.

Major Producers of Land Mines

Allied Countries	***Other***
Belgium	**Czechoslovakia**
France	**Egypt**
Germany	**Former Soviet Union**
Italy	**Former Republic of Yugoslavia**
United Kingdom	**Republic of China**
United States	

Table 1

Nevertheless, the world remains an inherently unstable place. The U.S. could become involved in any number of small-scale conflicts around the globe. The disintegration of Soviet power has increased the likelihood of destabilizing, low-intensity conflicts. This is compounded by a worldwide trend toward nationalism and intertribal conflict, as events in eastern Africa and the remnants of the former Republic of Yugoslavia have demonstrated. The situation is further complicated by the resurgence of religious fundamentalism in the Middle East and central Asia, which has increased the potential for civil and internecine warfare. Land mines will play an important role in all these scenarios.

The former Soviet Union and countries of the defunct Warsaw Pact no longer support Marxist client states by subsidizing them with military equipment and training. But these nations have hardly shut down production of arms in their weapons facilities. On the contrary, the new governments are seeking to obtain desperately needed cash by selling weapons to any country willing to pay for them. Sales of "big ticket" items are down because few nations can afford them in quantity. But the sales of small, man-portable weapons, particularly mines, are continuing at a brisk pace. A number of western and third-world countries have entered the business of manufacturing and exporting land mines as well (see Table 1). Some of these mines are quite advanced,[1] and many have begun to appear in global hot spots.

The proliferation of mines was dramatically demonstrated at the conclusion of Operation Desert Storm, when allied forces confiscated samples of land mines from nine countries of origin out of Iraqi ammunition supply points. Many of these devices were more advanced than most mines in the U.S. inventory.[2] (Fortunately for U.S. soldiers, the mines Iraqi soldiers emplaced by the millions along the Kuwaiti border were far less sophisticated.) The experience in Iraq illustrates that land mines are inexpensive and readily available. U.S. combat

These are a small portion of the thousands of mine types available today.

engineers, therefore, must be prepared to face a sophisticated mine threat, no matter where they are called to fight.

Since World War II, land mines have caused a surprisingly high percentage of casualties, particularly in counterinsurgency situations (see Table 2, page 5). They are the guerrillas' weapon of choice in any low-intensity conflict (LIC).[3] Mines provide guerrillas with an ideal economy of force capability and serve as equalizers against more sophisticated opponents. Properly employed, they destroy, disrupt, delay, deny (use of areas), and demoralize. Guerillas can emplace them with minimal risk, while significantly disrupting military operations and the civilian economy. Even advanced mines are relatively cheap and can destroy multimillion-dollar targets.

More than 2,500 mine and fuze combinations are in use today, and 650 million mines have been emplaced in the last 55 years. These figures indicate that mines will continue to rank at the top of the guerrillas' list of preferred weapons.

The proliferation of land mines partly explains why winning the peace after hostilities have ceased is becoming so difficult.[4] Locations like the Falkland Islands, which saw relatively limited conflict in a war that ended a decade ago, remain plagued by thousands of live and dangerous explosive devices.

Technology Advances

The last 20 years have witnessed significant advances in the technology associated with mine warfare. This technology is advancing at an almost geometric rate. Advanced electronic sensors and processors have been coupled with shaped charges or explosively formed penetrators. The resultant devices can defeat all known hard targets, such as tanks and armored personnel carriers—even those equipped with countermeasures.

Mine Casualty Trends			
Conflict	*Combatant*	*Casualties (Percent)*	
		Personnel	*Vehicles*
World War II (Italian Campaign)	United States	4.4	33
Korea	United States	10	56
Vietnam	United States	33	70
Thailand	Thai government forces	30	NA
El Salvador	Salvadoran government forces	90	NA

Table 2

The manufacturers of these electronic mines sometimes offer options such as integral antihandling devices, remote control on/off, and programmable self-destruct and self-neutralization. Several countries have fielded low-metallic mines that are extremely difficult to detect, even with today's improved mine detectors. The former Republic of Yugoslavia has manufactured both antitank (AT) and antipersonnel (AP) mines that contain no metal. Other manufacturers have developed hardened mines that have considerable blast resistance against explosive clearance devices such as the M-58 mineclearing line charge (MICLIC). These advances have created an unprecedented need for additional countermine technology.

The outbreak of Operation Desert Storm increased interest in counterobstacle equipment, particularly that needed to upgrade the breaching capabilities of armored and mechanized divisions. Between 1989 and 1991, the U.S. fielded the M-9 armored combat earthmover (ACE), the battalion countermine set for the M-1 tank, the mine rake for the M-728 combat engineer vehicle (CEV), and the M-58 MICLIC. (The MICLIC was fielded in 1986, but many using units did not train with it until Operation Desert Shield.)

The technology in all these systems, however, is of World War II vintage. As a result, U.S. breaching capabilities and tactics remain too slow and complicated to support the tempo of operations demanded by AirLand Battle doctrine.[6] Additionally, the U.S. Army remains poorly equipped to deal with mines in low-intensity conflicts.[7] Light force capabilities have not significantly improved since the Vietnam conflict. In fact, as with armored and mechanized units, light forces are essentially using World War II technology.[8]

> **Reinforcement of fundamental breaching techniques through repetitive training is a proven method for coping with unexpected obstacles.**

The Information Gap

U.S. combat engineers lack access to a comprehensive reference that identifies and describes the technical characteristics of recently fielded threat mines. Explosive ordnance disposal (EOD) teams use the TM 60H series *(EOD Procedures for Land Mines)*, but this excellent source of information is difficult to obtain. The last comprehensive reference for foreign mines available for general use was TM 5-280 *(Foreign Mine Warfare Equipment)*. This manual was last updated in 1971 and was rescinded in March 1986. Copies are scarce, and the manual

Countermeasures for Various Fuze Types

Type of Fuze	Detection Method	Breaching Method		
		Explosives	*Mechanical*	*Manual neutralization*
Tilt rod	Visual Detector	Slightly reduced effectiveness	Good. Expect some detonations	External antihandling device (AHD) is possible
Influence	Detector Probing	Significantly reduced effectiveness	Good. Expect some detonations	Blow in place only
Simple pressure	Detector[1] Probing	Effective	Good. Expect some detonations	Internal and external AHDs possible
Blast-resistant pressure	Detector[1] Probing	Reduced effectiveness	Good. Expect some detonations	Internal and external AHDs possible
Multi-impulse pressure	Detector[1] Probing	Ineffective	Good. Expect some detonations	Internal and external AHDs possible
Command detonated	Visual[2]	May cut surface-laid firing wires	Clears mines from front of vehicle. May leave off-route mines.	Internal and external AHDs possible

[1] The detection method depends on the metallic content of the mine.

[2] Some command-detonated fuzes may not be visual.

Table 3

provides no information on newer, more sophisticated mines.[9]

Several special-purpose documents, such as the *Mine Warfare and Recognition Handbook* and the *Sapper Countermine Guide* (both published for Operation Desert Storm), supplement TM 5-280, but these documents have limited scope and distribution. As a result, combat engineers must train to operate on the modern battlefield against a sophisticated mine threat without an inclusive, up-to-date countermine manual for guidance.

To help counteract this problem, the Countermine Directorate of the Belvoir Research, Development, and Engineering Center recently began assembling a mine/countermine data base in a software format that is compatible with both IBM and Apple computers. Although it contains comprehensive information on many threat mines available on the world market, the data base is not readily available to soldiers in the field.

Countermeasures

The recent advances in mine warfare technology have created a serious problem for U.S. combat engineers. The sophisticated mines have largely outstripped the countermeasures designed to defeat them, in terms of both capability and cost (see Table 3).

Advanced technology makes it difficult for U.S. soldiers equipped with mine detectors to locate many of the devices quickly and efficiently. Some cannot be located at all. Explosive countermeasures, such as the bangalore torpedo and the MICLIC, do not provide reliable neutralization of blast-resistant mines. In addition, while the battalion countermine set is extremely effective against most antitank mines, it is not designed to cope with the more sophisticated side-attack and top-attack AT mines being developed around the world.

The development and rapid proliferation of scatterable mines has created an additional complication, in that these mines can be emplaced at ranges up to 50 kilometers,[10] making them a significant threat to the rear. Units normally assigned to rear areas have virtually no experience in dealing with land mines or cluster munitions. Many of these soldiers' countermine experiences consist of brief overviews received during basic training.

No "Silver Bullet"

To address these deficiencies, the U.S. Army has developed the Countermine Modernization Plan. Approved in 1992, the plan prioritizes the development effort for promising countermine technologies. However, a countermine "silver bullet" is nowhere in sight. Even if the plan is fully funded (an extremely optimistic assessment considering current funding), technology can provide only part of the answer.[11] Combat engineers in the field must provide the rest, by combining available technology with good tactics, knowledge of the threat, and ingenuity to achieve an optimal balance.

Realistic training on a regular basis is essential for engineer units to accomplish their mobility missions on a modern battlefield. The mine threat is as serious as the NBC warfare threat, and unit training plans must reflect this reality. Units with missions for probable deployment into LIC environments should consider favoring countermine training over NBC training because land mines currently pose a greater risk than do chemical weapons.

Units can partly offset the information gap by using the following guides:

- Enforce the basic rules for negotiating a minefield; they are essentially the same, regardless of the type of mine present. Carelessly approached, a World War II vintage mine can kill as surely as the most modern, sophisticated device available today.
- Emphasize the use of basic battle drills in training to avoid unnecessary casualties. Reinforcement of fundamental breaching techniques through repetitive training is a proven method for coping with unexpected obstacles.

Summary

In an ever-changing world, land mines remain a constant, dangerous threat. Limitations in technology and information mandate the need for combat engineers to prepare for this threat through realistic training. Such training should provide experience and information on the critical characteristics of land mines currently available on the world market. Taken as a whole, the approaches discussed here can help ensure that combat engineers are adequately prepared to negotiate any minefield obstacle they encounter.

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Endnotes

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[3] *Sapper Countermine Guide,* BRDEC Pamphlet 350-4, Belvoir Research, Development, and Engineering Center, 30 November 1990, p. 9.

[4] "DOD Scientific and Technical Intelligence (S&TI) Support to International Mineclearing Programs," Briefing by Tom Reeder, Foreign Science and Technology Center, Charlottesville, VA, view graph #3.

[5] *Mine Recognition and Warfare Handbook,* U.S. Army Engineer School, Fort Leonard Wood, MO, November 1990.

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[7] *Vietnam Lessons Learned, 1965-1968,* Landmine and Countermine Warfare, Engineer Agency for Resource Inventories, Washington, D.C., July 1972.

[8] *Western Europe, World War II, Landmine and Countermine Warfare,* Engineer Agency for Resources Inventories, Washington, D.C., July 1973.

[9] *Foreign Mine Warfare Equipment,* TM 5-280, July 1971.

[10] *Sapper Countermine Guide,* p. 76.

[11] *Army Countermine Modernization Plan,* Department of the Army, 21 April 1992.

Engineers Respond To Operations Other Than War

By Major Robert M. Ralston and Lieutenant Colonel Douglas L. Horn

Military operations other than war (OOTW) involving large unit task organizations have been frequent occurrences in the last few years. FM 5-114, *Engineer Operations Short of War,* identifies several operations categories, one of which is disaster-relief operations within the United States and its territories. The 20th Engineer Brigade (CBT) (ABN Corps), stationed at Fort Bragg, North Carolina, has provided small, tailored support packages of soldiers and equipment to assist in disaster-relief operations several times since returning from the Gulf War. Deployment of the brigade and attached engineer units to conduct Hurricane Andrew recovery operations in Florida was the first major participation in OOTW. This article describes the steps taken by the 20th Engineer Brigade in responding to this natural disaster.

Hurricane Andrew

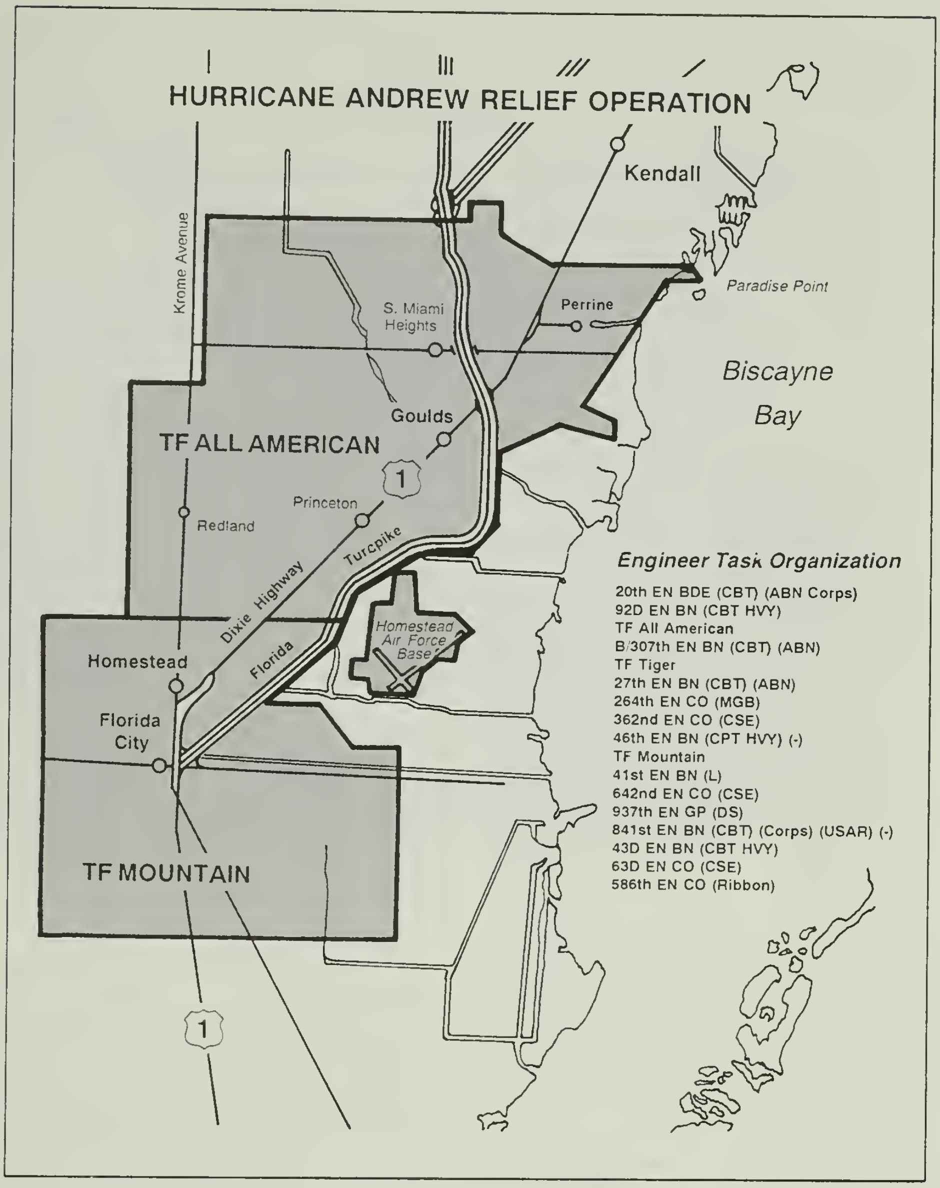
24 August—In the early morning hours, Hurricane Andrew slammed into the southern tip of Florida. The eye of the hurricane passed directly over Homestead Air Force Base and the surrounding communities of Homestead and Florida City with an estimated wind speed of more than 160 mph. The air base was destroyed, most trailer parks in the area were completely demolished, and the majority of housing in adjacent communities sustained heavy damage. The area lost all basic services.

The first military engineers to respond were soldiers of the 841st Engineer Battalion (USAR) stationed in the Miami and Jacksonville, Florida, area. Although the hurricane had destroyed their armory and many of their soldiers' homes, volunteers immediately began debris-removal operations, clearing main roads throughout the disaster area, the airstrip at Homestead Air Force Base, and select locations designated by city officials for the first of the dislocated personnel tent cities. Additionally, they provided transportation for the Red Cross and began initial debris-removal operations in Florida City.

Alert

27 August—Late in the day, Forces Command (FORSCOM) alerted the XVIII Airborne Corps and directed them to send an initial logistical task force to aid in relief operations. The Corps directed the 20th Engineer Brigade to begin deployment of forces and to have an airborne engineer battalion on the ground within 24 hours. With the first airplanes inbound, the brigade began crisis action planning for deploying forces in one-half the time of its normal 18-hour response time. In the planning stages, the brigade used the XVIII Airborne Corps' contingency plan for disaster-relief operations as a guide. Engineer units throughout the eastern United States were alerted by FORSCOM to be on call.

28 August—By 0530 hours, the brigade assault command post (ACP) had landed at Opa-Locka Airport, in North Miami, and was heading to the Homestead area. At 0600 hours, the first company of the 27th Engineer Battalion (A Co) began loading C5 aircraft at Pope AFB, North Carolina. Restricted by competing airflow requirements, it would take two days for the 27th Engineer Battalion to close in to the area of operations.


HURRICANE ANDREW RELIEF OPERATION

Assessment

29 August —Initial reports from the brigade ACP indicated that the situation was extremely bad. Even after five days, there appeared to be little organization to the relief effort. The main mission in the initial stages appeared to be strictly debris removal from land lines of communication. Based on the assault CP's assessment, brigade forces were told to leave their dozers and graders behind and to add extra bucket loaders when possible.

30 August—The brigade commander, Colonel Bob Melchior, arrived in Miami to survey the damage. He immediately asked FORSCOM to authorize the deployment of more U.S. Army engineers to assist in the relief efforts.

The brigade also began coordination with the U.S. Army Corps of Engineers (USACE),

Hurricane Andrew Fact Sheet

Deaths: **55 in south Florida, Louisiana, and the Bahamas**

Property damage: **Estimated over $20 billion**

People left homeless: **250,000**

Businesses destroyed or damaged: **82,000**

Lost jobs: **85,000**

Crop damage: **Andrew destroyed or damaged 80 percent of Dade County, Florida's 3,655 farms, at an estimated loss of $1.04 billion**

Jacksonville District, to define priorities of work and to coordinate the brigade's efforts with the district's. USACE had contractors performing temporary roof repair and minor debris removal. The brigade concentrated their planning effort in those areas not yet covered by USACE contracts. Attempts were made to coordinate with Joint Task Force (JTF) Andrew, but the JTF was still being formed. Later, the JTF engineer staff would be headed by BG Russell Fuhrman, commander of the North Central USACE Division, and staffed by the 36th Engineer Group, Fort Benning, Georgia, and by reserve engineer officers called to active duty.

Build Up of Engineer Forces

30 August—The 27th Engineer Battalion closed up on Homestead Air Force Base, set up an operations base at a local junior high school, and began disaster assistance operations in the surrounding communities.

31 August—The 43d Engineer Battalion (CBT HVY), Fort Benning, deployed 20 equipment operators to Florida to augment the 841st Engineer Battalion.

1 September—The XVIII Airborne Corps assault CP (ARFOR commander) and the 2nd Brigade, 82nd Airborne Division (TF All American), had deployed to the area, and the advance parties of the 10th Mountain Division (TF Mountain) began to arrive. Also, the 27th Engineer Battalion was augmented by the 264th Engineer Company (MGB) and the 362nd Engineer Company (CSE) of the 20th Engineer Brigade, and the remainder of the 43rd Engineer Battalion deployed.

2 September—The 937th Engineer Group, Fort Riley, Kansas, the 46th Engineer Battalion (CBT HVY) (-), Fort Rucker, Alabama, and the 92nd Engineer Battalion (CBT HVY), Fort Stewart, Georgia, were ordered to deploy. Additionally, the 34th Engineer Battalion (CBT HVY), Fort Carson, Colorado, and the 62nd Engineer Battalion (CBT HVY), Fort Hood, Texas, were alerted, although none of these battalions were to be deployed.

3 September—Six clean-up contracts totaling $90 million were signed by USACE. Contractors began mobilizing the next day, with full-up operations estimated to take up to a week.

Task Organization of Forces

Based on troop density and the engineers now available, as well as the location and severity of hurricane damage, the area was divided into sectors, as shown on the map (page 9), with the engineers task organized as shown. The engineer forces were augmented by USACE-contracted commercial equipment operators. These resources were controlled by U.S. Army engineers. While the use of the contracted equipment provided challenges, such as training soldiers to be contracting officer representatives, it considerably enhanced debris-removal operations.

Establishment of Bases of Operations

5 September—All deploying engineer units had closed in to the area of operations. A key player during these early stages of the relief effort was the Brigade Judge Advocate General (JAG) officer. Damage to the area, the number of displaced civilians, and the growing number of deployed units to the area made living space hard to obtain. The JAG was able to obtain excellent locations and prepare the necessary Rights of Entry forms. Engineers were located in such areas as the Metro Zoo, a beachside marina, a high school, a retirement home, and a county recreation camp.

A friendly resident watches the 27th Engineers load debris. Curious children added a safety challenge to the hurricane clean-up efforts.

The 20th Engineer Brigade conducted operations from a large, vacant warehouse centrally located in the disaster area and adjacent to U.S. Highway 1. An adjacent field was turned into a helicopter landing zone. A lack of interoperability of communications initially caused problems in coordination. Several engineer units had not been issued mobile subscriber equipment. The large warehouse allowed for housing engineer advance parties, maximizing initial coordination.

Areas of Responsibility

During the time frame required to deploy all military engineers, those units on the ground were busy with a varied amount of work. After the area's main roads were opened, debris-removal operations became a lower-priority mission. Clearing of areas for the establishment of disaster assistance centers (DACs), life support centers (LSCs), and mobile kitchen trailer (MKT) feeding sites and the removal of the associated trash and refuse from those areas became priority tasks. Overflights of the damaged areas with Dade County management officials also defined the military work effort as the debris-removal needs of the county were considered.

School Opening Takes Priority

Opening of Dade County schools became a major milestone for the metropolitan area to start on the road to recovery. JTF Andrew, in coordination with the county school board, developed a list of schools that were to reopen. The brigade obtained this list and purged it, identifying those schools located in the Corps sector. The engineer forces in each division sector were given their respective schools list and told to begin work on them.

6 September—JTF Andrew issued the school list to the XVIII Airborne Corps, but it included 58 schools located out of sector. The brigade was tasked to determine the level of effort required to open the out-of-sector schools.

7 September—The 20th Engineer Brigade sent eight teams from the 92nd Engineer Battalion to recon the 58 schools. This one-day recon was accomplished by using eight OH-58 helicopters flying predesignated sectors. The recon reports were consolidated and given to the XVIII Airborne Corps that evening.

Later that night, Corps issued a fragmentary order giving the 20th

The 43rd Engineers construct one of many temporary roads in the tent cities.

Engineer Brigade the mission of clearing the debris from the out-of-sector schools. Over the next six days, the brigade coordinated engineer unit efforts with the Dade County School Board repair crews and, via USACE, with the local megacontractor. Additionally, U.S. Navy SEABEE engineers helped clean up the classrooms and offices.

An interesting problem developed because debris had not yet been cleared from communities near the school. When local residents saw the schools being cleared, they began placing their debris on the school grounds. On more than one occasion, a school would be declared cleared one day and require more work the next. However, as the megacontractors increased their work effort in the neighborhoods, the problem diminished.

Defining Success

9 September—The first meeting between the JTF engineer, USACE, and Corps and Division engineers took place to reach consensus on the definition of success for the military engineers. With the forces on hand, the brigade estimated it would take over six months to remove all the debris left by the hurricane. Therefore, it was recognized early on that a transition plan with USACE was needed to hand over relief operations when required. Furthermore, as the megacontractors mobilized, their efforts began to overshadow the military's, as well as cause duplicity of effort.

It was decided that the priority for the military engineer effort would be school clearing, refuse removal from relief centers, and then debris removal. Also, Army engineers would provide vertical and horizontal construction effort in the construction of two additional relief camps. The first two camps had been built and were being maintained by U.S. Marines. The U.S. Army had responsibility for the next two camps.

Fortunately, the combat heavy battalions had brought their vertical sets, kits, and outfits. They constructed wooden flooring, installed lights and power, and installed basic plumbing. The only delays in the projects were caused by material delays and by initial indecision of local officials on which building codes should be followed. However, the initial decision not to include graders, dozers, or other horizontal construction equipment proved incorrect in the long run. In the tent city construction projects, graders and compaction equipment were needed to construct and grade temporary roads and to level rough areas. While the combat heavy battalions had brought some graders, no compaction equipment had been deployed.

Dozers also proved to be useful in debris-removal operations. The debris caused by Hurricane Andrew had been estimated by various government agencies to equal 35-years worth of trash for area landfills. Special permits were obtained to burn the debris, but additional dozers were needed to consolidate the material. Military dozers with operators were provided to the public landfills to help accomplish this task.

12 September—The XVIII Airborne Corps released two companies of the 27th Engineer Battalion for redeployment to Fort Bragg and subsequent deployment to the Jungle Operations and Joint Readiness Training Centers. Corps also released one company of the 92nd Engineer Battalion for redeployment to Joint Task Force 6 construction.

Completing the Mission

13 September—The last school was cleared.

15 September—The military's initial debris-hauling effort was critical to the mission's success because it enabled megacontracors and residents to enter areas and begin their clean-up efforts. However, by this date the military's portion of total cubic yards hauled had dropped from almost 100 percent to about 6 percent.

By the middle of September, electrical power had been restored to many of the areas, grocery stores and businesses were beginning to reopen, and the communities were beginning the long process of rebuilding. Refuse removal was being assumed by contractors, and the military's primary mission became spot checking DACs, LSCs, and MKT feeding sites to pick up overflow refuse. Furthermore, a notable difference could be seen during the daily aerial engineer recons as residents cleaned up their homes and neighborhoods.

> **"Engineer units are uniquely qualified to be a key player in successfully accomplishing OOTW missions."**

It was then that the focus of the Army engineers shifted. Debris-removal operations shifted from area coverage to point targets such as parks, churches, public areas, and nonprofit organizations. The megacontractors were concentrating on area debris removal and would not start on these specific areas of concern for a long while.

The point targets gave the engineers an opportunity to make a lasting impact on the communities. In anticipation of redeployment within the next two weeks, only short-term projects were accepted. This enabled the engineers to complete many point targets instead of half-completing a few large ones. The cleared parks and public areas provided campsites for civilian relief volunteers. Local officials appreciated this concept as more parks and public areas were restored.

Redeployment

20 September—As the brigade's organic units began redeployment to Fort Bragg, the remainder of the attached engineer units prepared to redeploy. The 92nd Engineer Battalion would remain to support the 10th Mountain Division, which would soon assume the role of the ARFOR commander. The 92nd Engineer Battalion would eventually redeploy on 7 October. However, it was several days after the military engineers had transitioned their missions to contractors before redeployment planning commenced in earnest. Redeployment was a sensitive issue—the military did not wish to portray redeployment as abandonment of the relief efforts.

When the redeployment order came, it released the 20th Engineer Brigade, the 937th Engineer Group, two combat heavy battalions, and two engineer companies, with redeployment to be complete within three days. Because no prior coordination was allowed, long delays in obtaining the necessary line haul occurred.

Overall, the mission of the military engineers was a success. They provided an immediate presence and debris-hauling capability, assisted in humanitarian relief missions, and gave area residents a sense of security and hope. For the first five days of their deployment, they were the only "engineers" present, and for the first days of the megacontracts, they provided a more-than-equal capability. Later, they took the lead in removing debris from schools. In the final days, they opened many parks and public areas, helping to restore normalcy to the disaster area. While facing many challenges and learning many lessons, the military engineers excelled, providing relief to those in need.

Special Considerations

Engineers involved in operations such as Hurricane

Andrew can find useful checklists in the current manual on OOTW (FM 5-114). Some additional considerations are:

- ***Coordination with government officials.*** Engineers must coordinate with federal officials, primarily FEMA and USACE. Furthermore, coordination must also be made with state, county, and city officials. Commanders can identify missions and priorities, allowing key tasks to be quickly started. This coordination will also establish mission objectives, major milestones, and the definition of success.
- ***Coordination with civilian contractors.*** Coordination between the military engineers' work effort and that of civilian contractors is vital in preventing duplicity of effort and conflicts. Once mobilized, contractors do not want military engineer work efforts to interfere with their profits in contracted engineer work.
- ***Standardized relief camp construction.*** Construction standards for life support centers must be determined from the onset. These standards, whether federal, state, or local, will affect the work efforts and materials required to complete the centers. Hesitation or changing requirements will only delay completion.
- ***Standardized map usage.*** Many types of maps are available, from highway to realtor to U.S. Geological Survey. A timely decision is required to establish the standard theater of operations map.
- ***Lead time for redeployment.*** Several days' lead time prior to the redeployment date is required to ensure a smooth and timely transition. Contracting for the line haul required to move combat heavy battalions takes several days to accomplish. If required, the planning for redeployment can be conducted as a classified operation.

Summary

The conduct of JTF Andrew's disaster-relief operations was accomplished within the ARFOR by overlaying the civilian area of effort with a military task organization operating within unit boundaries. This allowed all military units to conduct coordinated relief operations upon arrival into the area of operations. Engineer units are uniquely qualified to be a key player in successfully accomplishing OOTW missions. It is important to plan to coordinate with both the public sector and the appropriate government agencies, a requirement not normally associated with a unit's war-time mission. Hopefully, this article has provided some pointers on successfully executing the next operation.

MAJ Robert M. Ralston currently serves as training officer of the 20th Engineer Brigade. His most recent assignments include operations officer for the 20th (during Hurricane Andrew Relief Operations) and commander of C Company, 307th Engineer Battalion, 82nd Airborne Division. A graduate of the Command and General Staff College, he holds masters degrees from Purdue and the University of Florida.

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Lessons Learned

The February 1993 edition of ENGINEER, page 26, presented some lessons learned that should help platoons, companies, and battalions deploying for disaster relief. Senior commanders should consider some additional "higher headquarters" concerns:

- Getting engineer intelligence and assessment teams on the ground early.
- Anticipating the need for haul capability (such as bridge trucks), vertical construction, and horizontal capability (compaction and grading in life support centers).
- Planning for and deploying early liaisons for federal, state, and local governments and municipal utilities.
- Pushing for early resolution of defined objectives, the definition of success, and liaison procedures.
- Knowing which officers in the command have contracting officer representative (COR) or USACE experience. They should also consider OPDs for COR functions such as contract administration and work effort/trip ticket reporting systems.
- Coordinating early with USACE on contractor priorities and work areas.
- Ensuring that maneuver commanders know USACE contractor procedures, capabilities, and initial work areas.
- Identifying community requirements as soon as possible. Priority missions may be short notice and outside the area of operations. They should look at the calendar and think civilian; for example, schools and elections.

Wake Up, Engineers!

By Lieutenant Colonel William C. West

Wake up, engineers! It is time to sign up for the Bradley fighting vehicle (M2) and the Abrams tank (M1) with mine plow to replace the M113 and the CEV in heavy divisional engineer brigades. Engineers must contribute more to the combined arms team. The Bradley fighting vehicle and the Abrams tank with plow provide such an opportunity.

Budget Realities

The future will require the U.S. Army to maximize the contribution of each and every weapon system in the force structure. Elements that do not contribute significantly will be the first to feel the knife in future budget cuts. Opportunities to deploy and train will go to those units maneuver commanders find indispensable.

This picture should be clear to any engineer battalion commander who has tried, in vain, to have an engineer battalion with all three companies support the rotational brigade at the National Training Center (NTC). The answer is always "No." Would this be true if engineers were equipped with the Bradley fighting vehicle and the M1 with mine plow? I think not! Engineers would easily gain support to have FORSCOM Regulations 350-50 revised to include the entire engineer battalion. To have our voices heard and understood in today's Army, engineers must talk in terms the infantry and armor understand. Their language focuses on combat power—the M2 and M1.

Engineer Contributions

Divisional mechanized engineers must realistically appraise their current and future contributions to the combined arms team. Engineers are more readily occupied players during defensive than offensive operations. The reason is simple: During defensive operations, engineers contribute to the countermobility effort by emplacing obstacles and preparing survivability positions. During offensive operations, participation of engineer squad members usually is limited to a few engineer soldiers attached to the scout platoon, while the remaining engineer squads prepare to breach and mark lanes and bypasses. Engineers do not possess viable countermine equipment for today's modern battlefield. CEVs and MICLICs mounted on the M60 chassis are often nonmission capable. The MICLIC is only effective against single impulse mines, and the ACE is not designed for countermine operations. Only a few engineers are used as scouts because space inside the scout platoon's vehicles is limited. Engineers often trail the maneuver formation, waiting to mark lanes and bypasses or attempt a manual breach if the M1s with mine plows become inoperable.

Maneuver commanders sometimes make the engineer the breach force commander. However, they are reluctant to provide him with the number of M1 and M2 vehicles required to achieve success. Should we expect a maneuver commander to entrust the combat power of the M1s and M2s to someone who is not trained to utilize these assets? Again, the answer is "No."

Generally, during rotations at the NTC, engineer battalion staffs are not adequately trained to conduct the planning process required to direct a brigade deliberate breach. When assigned the breach force mission, most engineer staff officers and commanders are unfamiliar with the capabilities of the M1 and M2, and unpracticed in maneuvering large formations on the battlefield. Brigade commanders, therefore, hesitate to assign an engineer battalion a battalion mission in offensive operations. Should the engineer battalion be given the mission and the operation fail, another opportunity to be in command of such a force may not occur. That's why the engineer battalion staff is usually an underutilized asset during offensive operations.

Rationale

Replacing the M113 with the Bradley fighting vehicle is right for the engineers. Countermobility missions on the modern battlefield will be more equipment intensive than manpower intensive. The fielding of scatterable mine systems (Volcano, WAM, MOPMS, etc.) testifies to our reliance on technology. An engineer squad mounted in a Bradley has five dismounts, while the rest of the crew (driver, gunner, and commander) remain in the vehicle. The Bradley's increased capability to provide security with the 25mm gun and long-range antitank (AT) fires from

(Continued on page 42)

Corps Reorganization:

Few Impacts on Engineer Officers

Note: Implementation of the Corps of Engineers reorganization has been on hold since February 1, 1993, the scheduled activation date for five newly restructured divisions. The delay is necessary to coordinate the plan with the Secretary of Defense. At this time, the plan is subject to modification by the Secretary of Defense and Congress.

By Lieutenant Colonel J. David Norwood

The U.S. Army Corps of Engineers announced plans on November 19, 1992, for a sweeping reorganization that would affect all levels of the Corps. Yet, despite completely restructuring the organization and eliminating 2,600 civilian positions, the proposed reorganization would not significantly affect placement opportunities for Army engineer officers, especially majors and captains.

The heart of the plan is to decrease the number of Corps divisions from 11 to six, consolidate technical and administrative functions, and reduce levels of policy and technical reviews. All district offices would remain open and would retain project management and construction, operations, maintenance, regulatory, and emergency functions.

A comprehensive reorganization of the Corps is necessary because of fewer traditional projects and a shrinking work load. Since 1965, civil works engineering and construction work has declined by nearly 40 percent. Since 1986, 41 percent of the districts have had two or fewer new start projects and 42 percent have had no new authorized projects—the best indicator of future civil works design and construction. While the decline in the Corps' military construction program has not been as drastic, it has substantially reduced during the past decade. This trend is expected to increase as the armed forces continue their post cold-war drawdown. Other compelling reasons to reorganize include high overhead costs and imbalances between the work load and the work force.

The purpose of the reorganization is to reduce the cost of doing business, enhance technical competence, and provide flexibility to meet the demands of a changing work load. The plan would improve the way the Corps works and serves its customers now and in the future.

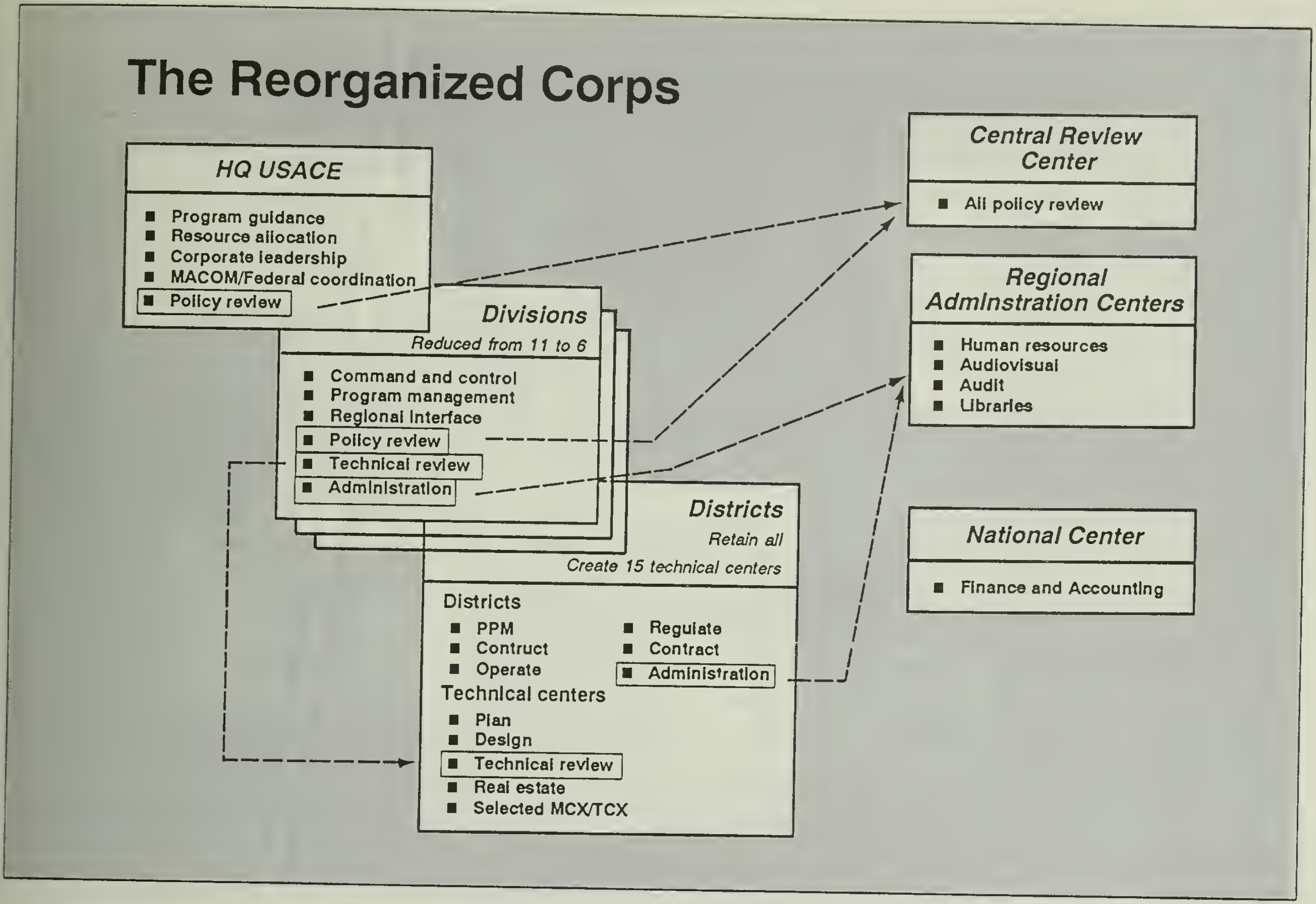
The plan has a projected one-time implementation cost of $215 million and would save taxpayers $115 million annually. The two-phase implementation would be spread over a three-year period.

Phase I

Cost and Implementation. The Fiscal Year 1993 Energy and Water Appropriations bill (the first appropriation toward reorganization) includes $5 million for Phase I. This phase focuses on headquarters and division reorganization and begins by activating the five new divisions in 1993. After the activation ceremony, the closing division staffs would take orders and advice from the restructured divisions until the moves are completed.

During this phase, a new district in the Boston area would replace the former New England Division. Also, oversight for the Alaska district would transfer to the Pacific Ocean Division.

Impact on Army Officer Positions. Phase I would eliminate four general officer command positions and four colonel, deputy commander positions when the current divisions are deactivated. This would save eight positions for overall Army officer reduction, but the drawdown would probably offset that. Two results are expected: first, the additional officer positions would be lost; second, the officer spaces saved by the reorganization would not be available for reassignment within the Corps.



Phase II

Cost and Implementation. Phase II would focus on district realignment and the activation of technical and administrative centers, without closing any districts. The plan calls for reorganizing district offices, which are the Corps' public and military installation-level liaisons. This part of the reorganization was scheduled to begin in FY 94 and end in FY 95, pending congressional funding.

Technical Centers. The planning and engineering functions currently performed at all districts would be consolidated in 15 technical centers within 15 existing districts. Ten centers, two per division in the continental U.S., would be designated as military centers to handle the Corps' military construction program.

Consolidating the planning and engineering functions into technical centers offers several benefits for the Corps and its customers:

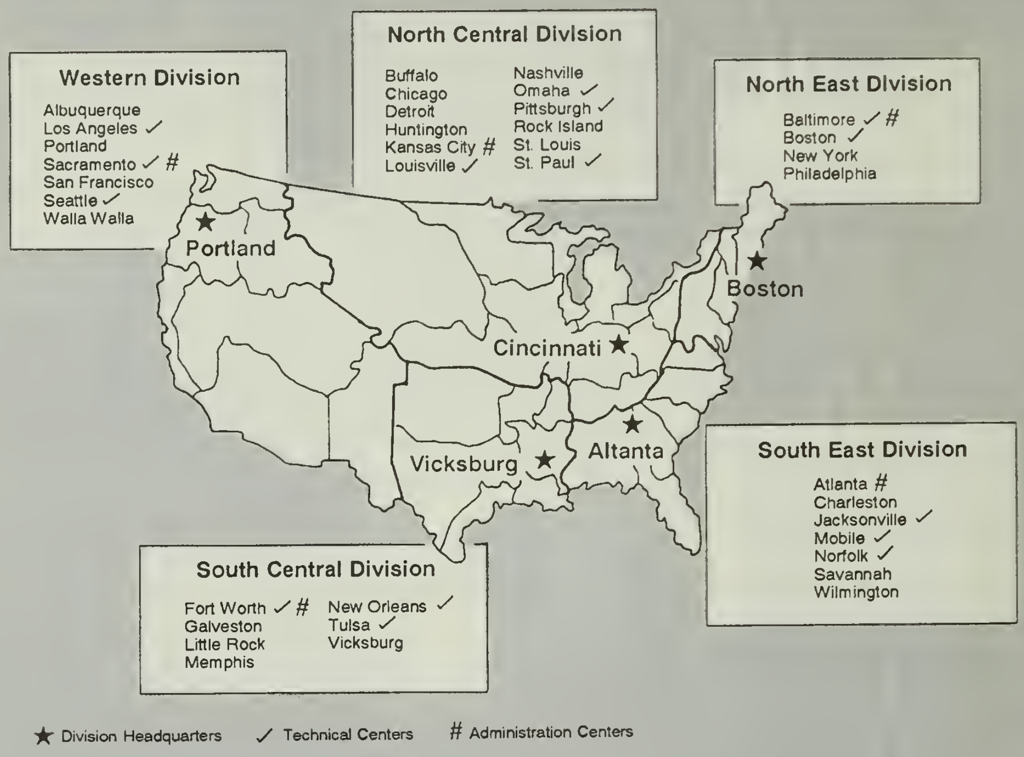
- Each center would have a greater concentration of technical expertise to apply to projects. Thus, skills development for engineers and planners would significantly improve. Positions would offer a wider variety of work challenges, and staff opportunities for job enhancement and career progression would increase.
- Project managers would have a choice of technical centers for their projects. This would foster competition among the centers to provide the best products and services. In addition, it would encourage planners and designers to reduce costs, stay within time schedules, and provide further incentives for creative engineering solutions.
- The Corps would be able to better manage workload fluctuations, without significant increases or decreases in the professional staff.

The technical centers would absorb an existing layer of technical review and would pass project plans directly to the Washington, D.C.-based Central Review Center for policy review. This change would eliminate time-consuming technical and policy reviews at divisions. Technical centers would not review their own work but would review other centers' work on a reciprocal basis.

Going outside the district for such expertise is not a new concept. Under the current organization, districts frequently export projects to other districts or contract them to architectural or engineering firms. Districts would retain responsibility for quality, cost expectations, and meeting the customers' functional requirements.

Administrative Centers. Additional savings would be realized by consolidating administrative functions

Restructured Divisions with Districts



Western Division

Albuquerque
Los Angeles ✓
Portland
Sacramento ✓ #
San Francisco
Seattle ✓
Walla Walla

North Central Division

Buffalo
Chicago
Detroit
Huntington
Kansas City #
Louisville ✓
Nashville
Omaha ✓
Pittsburgh ✓
Rock Island
St. Louis
St. Paul ✓

North East Division

Baltimore ✓ #
Boston ✓
New York
Philadelphia

South East Division

Atlanta #
Charleston
Jacksonville ✓
Mobile ✓
Norfolk ✓
Savannah
Wilmington

South Central Division

Fort Worth ✓ #
Galveston
Little Rock
Memphis
New Orleans ✓
Tulsa ✓
Vicksburg

★ Division Headquarters ✓ Technical Centers # Administration Centers

Note: *The Pacific Ocaan Division, which includas tha Alaskan and Honolulu Districts, is retained but not shown.*

throughout the Corps into administrative centers, one in each division. These centers would initially perform some human resources, audiovisual, library, and audit functions. In the future, they may evolve to gain other functions that lend themselves to consolidation.

Finance and Accounting Center. The reorganization plan also calls for a national finance and accounting center to consolidate payroll and other finance and accounting functions. Establishment of the center was mandated by a Defense Management Review Directive of the Department of Defense.

Impact on Army Officer Positions. Creation of the new district in the New England area would result in a total of 39 districts, eight of which are currently commanded by lieutenant colonels. In addition, phase II of the reorganization would likely result in the downgrade of three to eight more district command positions from colonel to lieutenant colonel. Exactly which positions or how many would be downgraded would not be known until the structure of the new districts is analyzed.

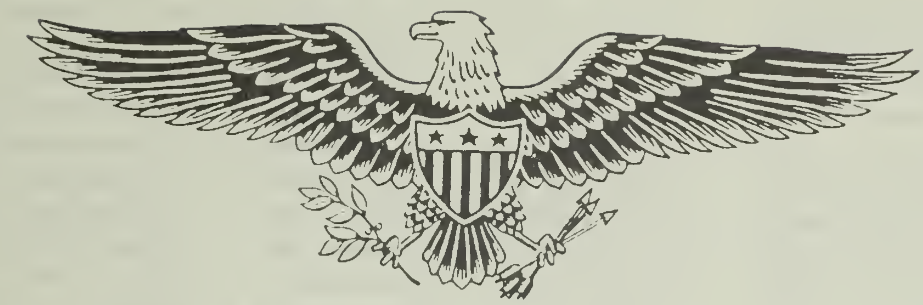
The reorganization would not affect the number of captain positions within the Corps. Captains serve as project engineers, and the only change currently planned for them is the office to which they would report.

The overall Army downsizing will create a more significant impact on engineer officer opportunities in the Corps. As the Corps takes its officer reductions along with the rest of the Army, staffing the organization with military personnel will become much more difficult.

Future Expectations

Although the Corps reorganization would be extensive, few changes would be noticeable to customers. Districts would retain essential services, and project sponsors would continue to deal with one district engineer, one project manager, and one construction and operations team. The impact on Army engineer officers would also be minimal. The Corps would continue to fulfill its mission, while substantially reducing project costs and providing more timely and effective service.

LTC J. David Norwood is the Deputy Chief of Staff for Headquarters, U.S. Army Corps of Engineers, in Washington, D.C. His most recent assignments have been in USAEUR as the S3, 18th Engineer Brigade; and XO, 78th Mechanized Engineer Combat Battalion. A graduate of the U.S. Military Academy, he earned a masters of science in civil engineering from the University of Illinois. LTC Norwood is a registered professional engineer in Virginia and Tennessee.



Leadership Prerequisites for Our New Army

> *"It must be remembered that there is nothing more difficult to plan, more uncertain of success, nor more dangerous to manage than the creation of a new order of things. For the initiator has the enmity of all who would profit by the preservation of the old institutions, and merely lukewarm defenders in those who would gain by the new ones."*
>
> *Nicolo Machiavelli, 1513*

Times Are Changing

Let's paint the scene. Reductions in force, special separation benefits, variable separation incentives, and Selective Early Retirement Boards have taken their toll; the avoidance of the term "downsizing" has led to the idea of "rightsizing" in an attempt to show that all is back on track. But there is an undertone of concern, frustration, and fear. Transition "chop shops" are common, risk taking is on the decline, and hull defilade is more apt to describe one's approach to the daily routine than the maneuvers of an M1A2 tank. Redundancy is gone, local training is now a major training event, and the requirements continue to roll in with fewer resources than ever before. For most leaders, all this adds up to a critical mass disaster; but not for me!

I buy into the fact that our Army is better than ever before and will continue to improve. I understand the need for change and look forward to our new Army. It is time for the "nay sayers" to get out of the way and for leaders who can see the future to take charge. But we will fail if we rely on our old ways of doing business. Tasks, conditions, and standards are different. Our Army needs a new generation of leadership thought. Our core values remain, but our energy needs to be outward, not inward. Leadership, not management, is needed within our new Army, and it requires flexibility and vitality.

What is behind this "chicken little/sky is falling" uproar? Perhaps we are trying to put old, square pegs of rules into the round holes of our new environment. Perhaps we need to recognize that what was, is no longer. This does not necessarily mean that the "good ole days" are gone. Those days were not as good as we make them up to be. What was nice about them, though, was that we were used to them. It felt good to be within a friendly comfort zone. But that was yesterday. Listen—it's our wake-up call. We need to change, given the changes to our Army, if we are to be what our nation demands.

"New Leader, This Is Op 1, Over"

We have all seen some corporate giants tumble in confusion as they reel in disbelief at the impact of internal downsizing events. I have had the unique opportunity to study these blue chip industries and to spend time talking about lessons learned with their leadership. Additionally, I have been part of the Army's look into organizational change. Now I find myself in the middle of that change.

My conclusion is that we are in a mine field, but we can avoid injury. All it takes is an understanding of the changes and a quick look at the errors and successes of others. First, we should seek to understand the changing Army before we try to be understood. "Listen, learn, and then lead" applies to each one of us. We need to break away from old habits that limit our vision. Enough said; here is a series of reports from my observation post.

By Colonel Herb Harback

"I Have 12 Changed Conditions To Report. Are You Prepared To Copy? Over."

SITREP 1: ***Powering down is not an option; it is a critical first step in mission success.*** As levels of staffing are removed, those who remain must be trained to fill the gap. Smaller units will demand remote control, not more control. But it is not automatic. You power down to the lowest level that can still assure success. Cross training comes into play. The more a team practices it, the more empowerment can take place. It is wrong to assume that centralized control will expedite decision making. You centralize for policy making, decentralize for execution. This means a greater use of task force structuring to accomplish the mission. "One size fits all" and "one command structure makes it simple" are not valid concepts in our new Army.

SITREP 2: ***Leadership training costs money and time but is not an expense; it is a necessary investment.*** Too often, leadership training is viewed in the "nice to have, but" category. Leadership development is a long-term process with a lag time effect. You can cut it now and no major disasters will immediately happen. The disasters will be seen in future failures. Desert Storm's victory was a result of long-term leader development, not a product of some shake and microwave bake instant recipe. Now is the time to train the leadership for the Desert Storms they will fight in 10 or 20 years.

SITREP 3: ***Sustainment is out; betterment is in.*** Continuous improvement must be the new mind-set. Sustaining the status quo is another way of stating the destined-to-fail saying, "if it ain't broke, don't fix it." Total quality within our new Army depends on an improvement process. We don't want perfection, just improvement. It costs too much for perfection. It is far better to see a 1 percent improvement in 100 areas than a 100 percent improvement in one area. Additionally, every action must be scrubbed through a "value added" gauntlet and then executed with speed and zeal. Value-added thinking must be part of empowerment.

SITREP 4: ***All successful missions start with a vision.*** If you do not know where you are going, you will never get there. Vision—study it, understand it, build upon it, see it, and do it. You must begin with the end in mind. Once a vision is developed, it must be visualized—brought into focus with measurable goals. That focus must be a battlefield focus. Leaders must learn to face toward the sound of distant guns. No matter how common and garrison-duty-like a mission is, it must be taken on with combat aggressiveness and orientation. Know where you are going and translate all actions into a readiness mentality.

SITREP 5: ***A positive spin to recruitment and retention is critical.*** The new Army must be made up of winners not survivors. Our approach must be to select people to be part of the team, not select people to leave it. We will do far better to spotlight the improvements brought about by the new Army, rather than moaning the absence of old ways. We need to build on our strengths and minimize the time focused on our weaknesses. If each member of the team (be it squad size or division size) works on improving his strengths, we will be able to obtain true synergy.

Your attitude sets the boundaries for your accomplishments. We are a smaller, newer Army but still have vital missions to accomplish. How we approach them and the results of our efforts, will, in large part, be a direct reflection of our attitude. We don't have the depth anymore for anybody to have a bad attitude. Attitudes can't be hidden. Our attitude sets our azimuth for success or failure. We can have a bad day, but our attitude, our spirit, and our feelings about ourselves and our soldiers must be solid and upbeat.

SITREP 6: ***Murphy was neither RIFed nor SERBed.*** There will be mistakes. Not all challenges are opportunities, some are just what they seem to be—pains that must be overcome. There is no need to beat one's breast over it; just get on with it. The old adage that "leadership comes from making the right decisions, right decisions are made through experience, and experience comes from making the wrong decisions" tells us that Murphy is part of the developmental process. The way to minimize this type of experience is to learn from the experiences of others. In fact, the new Army demands it. We have neither the time nor the resources to have each person experience all, firsthand. Experience must be gained from multiple sources. Firsthand experiences are one-dimensional and too slow. Mentoring, hot washes, and lessons learned updates are critical parts to our new Army.

SITREP 7: ***What got us here today will not get us where we need to be tomorrow.*** We must adjust ourselves to new situations with the same degree of finesse as we adjust fire. It makes sense—when we have a moving target, we need to adjust our aim. Likewise, as the Army and its missions change, we must change. We cannot assume that the techniques which were acceptable on old missions will be appropriate for new missions and structures. Relying on past formulae will find us overmanaged and under-led. No doubt there are risks in doing new things and being paradigm pioneers, but I believe there are even greater risks in doing nothing and remaining paradigm settlers. Remember, no one wants obsolete excellence. Don't mistake the edge of a rut for the horizon.

SITREP 8: ***Mission is number 2.*** If you are a leader and you are totally focused on the mission, you will fail in the long run. Your soldiers must focus on the mission. To them, it is number 1. Your job is to focus on your soldiers. Only when you commit yourself to caring for them will they be able to totally dedicate themselves to the mission at hand. Caring means establishing, communicating, and enforcing standards. It means providing vision, focus, training resources, and the positive environment for success. You take care of the troops, and the troops will do the rest.

SITREP 9: ***If you are not an active part of the solution, then you are working against the success of the mission.*** Stated in mathematical terms, the probability of success plus the probability of failure is equal to one. Either you are a team player working with the team or you are not. There is no middle of the road in the new Army. The fluff and ability to drift in indecisiveness are gone. And that is good.

Our organizations are downsized to the extent that we can only use active team players. Passengers—those folks only along for the ride—can't be accommodated. Additionally, this new focus on teamwork requires direction, trust, and commitment. Team building begins with a determination of a direction—a vision. This, in turn, leads to a team "oneness" where trust is nurtured. Without trust, there is very limited team action. Communication is censored, and bureaucratic and turf battles ensue. Finally, there is commitment. Commitment, not authority, produces long-term results. It allows for a synergistic effect to happen as we move from independent individuals to an interdependency where the actions of the whole are greater than the added efforts of each member.

SITREP 10: ***Compete to a standard not to one another.*** Establish the standard of excellence appropriate for the mission. Don't set it too low, guaranteeing failure, nor too high, guaranteeing long-term failure. Competition against individuals creates a win-lose proposition. It endorses failure by allowing for only one winner, with all others being marked as failures.

Likewise, placing all of the time and energy on one person does not ensure success. Superstars are too expensive and weaken any team building. It is amazing how much can be accomplished when no one person takes the spotlight. The new Army is based on a winning team, not individual winners. Our leadership must be built around this principle.

SITREP 11: ***Leadership is an event, not a position or a person.*** This means that we need to train in leadership, just like we train for an event. Through continuous improvement in our training, we will be able to successfully execute our responsibilities when our leadership time arrives. Practice, in itself, is not enough. Alone, practice makes one well practiced, not better. It is constantly improving practice that we seek to accomplish. And when is it enough? When we hit the level of excellence we have established. The actual leadership event is not the hard part; it is the training that comes before. Training requires determination, dedication, and resources. It is neither easy nor free, but it is essential. Additionally, leaders must be masters of transitions. Quick and seamless transitions are the key to winning. For the runners on a relay team, it is the handoff, not the speed on the straightaway, that sets the conditions for winning. Likewise, the way we transition provides the mark for our mission successes.

SITREP 12: ***Strategic leadership is possible at all levels of command.*** Many believe that strategic leadership is found only at the highest levels of command. I believe strategic leadership is at all levels. It is when a leader looks beyond his immediate responsibilities and can see distant missions and requirements—it is looking outside the defined "sandbox" of responsibility. In our new Army, strategic leadership development will be at all levels. It will be more complex and distant at the higher levels of command, but it will be recognized at all levels.

"End Of Message. How Copy?"

There are three types of people—those who make it happen; those who watch it happen; and those who wonder what happened. Our new Army needs only the first group. I am sure the Titanic had some great managers, but what they needed was someone trained in leadership. Let someone else arrange the deck chairs; we need visionary leaders in command. Leaders who embrace change and make it happen. The old "now what, Lieutenant?" vignette is happening now for all leader ranks. The difference is that our new Army is at stake. Don't dally; don't shed a tear or look back. It is a great new Army, so get fired up, be part of the change, and move forward.

Colonel Harback is commander of the Louisville District, Corps of Engineers. Previous assignments include commander, 14th Combat Engineer Battalion; and XO, Bayonet Combat Support Brigade, 7th Infantry Division. He has masters degrees from N. Illinois University and Long Island University and is a graduate of the Command and General Staff College and the Army Strategic Studies Institute.

Somalia and Operation Restore Hope

By Major James R. Brannon and Mr. Vernon Lowrey

The following Lessons Learned are some of the emerging early problems experienced by U.S. Army, Navy, Air Force, and coalition forces in Somalia. The enormous scope of the human tragedy in Somalia was compounded by the austere conditions and a complete breakdown of civil order and structure. The situation presented engineers with several new and recurring challenges.

The mission of U.S. forces in Somalia was to provide a secure environment so nonmilitary aid workers could distribute food and other humanitarian supplies. U.S. Army engineers provided mobility (countermine operations, road repair and bridge construction), survivability (force and food protection), and sustainment engineering (base camp construction, road and airfield repair, and utilities support) for both U.S. forces and civilian aid workers. For more information write to: Commandant, U.S. Army Engineer School, ATTN: ATSE-ESA-L, Fort Leonard Wood, MO. 65473-6630. Or, call (314) 563-5303, DSN 676-5303.

ISSUE: The availability of Class IV construction materials was severely limited in Somalia.

DISCUSSION: Somalia presented operational planners with a unique environment because a civil infrastructure was almost totally absent. Class IV materials (construction materials, lumber, nails, cement, gravel, etc.) were simply not there. Everything engineers needed to complete missions and sustain soldiers had to be brought in from as far away as the United States.

Immediate missions to open supply routes required dust palliatives, gravel, and cement. Concertina wire, sandbags and huge numbers of pickets were needed for force protection. Bed-down and base-camp construction (latrines, showers, tent floors, tables, etc.) had to be built with imported materials. Aggregate (sand and gravel) borrow pits were located only through effective engineer reconnaissance. With so little in the country, units that brought in what they could pack or carry had an edge on security and comfort.

Typically, Class IV materials are bulky and expensive and often have long lead times for procurement. In Somalia, it took about 30 days to obtain an adequate flow of Class IV construction materials.

RECOMMENDATION: Implied missions often drive the immediate need for Class IV materials. Units that have the time and haul capacity should take everything they can when they deploy. Recommended minimal supplies are: concertina, stakes, pickets, and sandbags for security; plywood, lumber, nails, forklift pallets, exterior electrical wire (Romex type), electrical fixtures and supplies for base-camp construction and bed-down facilities. Units should consider ordering in advance a standard base camp in 500- or 1000-man increments from the bills of material (BOM) found in the Army Facilities Component System (AFCS). Units unable to prestock or preload Class IV items should ensure their SOPs address troop security and bed-down procedures for extremely austere environments.

ISSUE: Operation Restore Hope required U.S. and other U.N.- member military forces to engage in countermine operations.

DISCUSSION: The worldwide proliferation of land mines places U.S. forces at risk on almost any deployment. A mine blast caused the first U.S. casualty in Somalia, killing a Department of the Army civilian. U.S. Army, Marine and coalition engineers executed countermine operations: They were required to predict, detect, remove, proof, and clear both major supply routes (MSRs) and other critical areas.

Local villagers provided intelligence to locate many mined areas and roads. Some units reported that local Somalis handed over mines they found to U.S. forces, wanting to exchange them for food.

Countermine operations are always very dangerous. We found that the current fiberglass mine probe breaks easily in rocky soil. All forces used their bayonets as substitutes. Soldiers slid their bayonets horizontally through the soil as they probed, well below a 45-degree angle. This kept the tip of the probe in a position to contact the lower sides of mines rather than the top. Army doctrine (FM 20-32, *Mine/Countermine Operations*) advises using a nonmetallic probe to reduce the risk of detonating magnetically fuzed mines. A nonmetallic probe is still recommended, but soldiers must be prepared to use more risky methods and increase their precautionary measures accordingly.

Several point mine fields, with no pattern, were found at the sides of roads and in bushes. Most were not buried and many were improperly fuzed. Engineers used four-man teams to detect and mark mines. Mines were removed and destroyed by two-man demolition teams, using satchel charges or prefabricated "pop and drop" charges.

U.S. Marines proofed routes by pushing a civilian roller in front of their armored vehicle. The roller was equipped with a prefabricated "dog-bone" to detonate any tilt-rod mines. Army engineers used the Mine Clearing and Armor Protection Kit (MCAP) without the rake to proof cleared lanes. Routes were marked with dry quicklime because standard marking signs and tape were often pilfered. The quicklime was dispensed from squeeze bottles.

RECOMMENDATION: Maintain training standards for mine detection, recognition, and clearing techniques, particularly the detection and clearing methods appropriate for low-intensity conflict scenarios. Mine detector teams can practice by listening to the tones their mine detectors make when passing over sample mines. This will fine-tune the soldiers' ears, especially for nonmetallic mines. The use of plows and rollers may be totally unsuitable for an operation where MSRs must be quickly used by nonmilitary logistics traffic.

When mines pose a likely threat, remember:

- Sand-bag your vehicle (floor boards and under the seats).
- Be aware that mine fields in developing countries may have no order, pattern, or predictability about them.
- Seek out and exploit local sources of human intelligence. Local people often know where mines are.
- When making a risk assessment for countermine operations, use the Intelligence Preparation of the Battlefield (IPB), based on the factors of METT-T (mission, enemy, terrain, time and troops available).

ISSUE: Main supply routes and other key lines of communication in many developing countries will require military bridging. Engineer soldiers must be prepared to install all manner of military bridging, but the Bailey bridge is likely to be the bridge of choice.

DISCUSSION: The 41st Engineer Battalion (Light) constructed two Bailey bridges across the Jubba River, in southwestern Somalia. The soldiers built a 160 foot, Class 50 triple-double bridge, with one intermediate pier 40 feet from the near shore. The complexity of the bridge design required technical assistance from two senior bridge instructors (12C4) at the Engineer School.

Total construction time was three days, 22-24 January 1993. Construction time averaged 30 minutes per double-story bay. Perforated steel plate (PSP) was placed over the deck chess in a staggered pattern and welded in place to prevent pilferage of the decking. All bridge components were welded in place. Two Bailey bridge sets and two bridge erection sets were employed. The 41st Engineers also built a 70-foot, double-single Bailey bridge and repaired another bridge in Bardera. Canadian engineers used the remaining components to build a 70-foot, double-single Bailey bridge near Mataban.

RECOMMENDATION: Engineer units must be prepared to construct military bridges, even though bridging may not be part of their mission essential task list (METL). The following tips can ensure quick train-up:

- All engineer units should maintain a complete library of bridge manuals and take them on all deployments.
- Junior leaders (platoon sergeants and platoon leaders) should be able to design a bridge site layout.
- Unit commanders should ensure that their Officer Professional Development (OPD) programs include regular reviews of bridge construction, site layout, site security, and bridge park design and security.

ISSUE: Large numbers of starving people are difficult to control. Population control measures are essential for force protection.

DISCUSSION: U.S. forces were subject to random drive-by shootings, rolling grenades, and mortar fire inside compounds at the U.S. Embassy, the airfield, and the seaport. Relief centers were easily overwhelmed by surges of people needing food, water, clothing, shelter, and medical aid. These conditions are most likely to occur during the initial phases of any mission attempting to restore order. At the feeding centers in Somalia, long lines of people easily became unruly crowds that were difficult for relief workers to handle. Queuing systems constructed with concertina, stakes, and sandbags aided crowd control by establishing orderly feeding lines. The queues calmed the anxious people and simplified both crowd control and site security.

RECOMMENDATION: Units deploying on humanitarian relief missions should take sufficient obstacle materials (sandbags, concertina, engineer tape, pickets, etc.) to construct force-protection and crowd-control measures (queuing systems). This is especially true when long lines of people must be managed.

ISSUE: Waste and trash from U.S. military operations are often seen as valuable to local inhabitants in poor, developing countries.

DISCUSSION: People in developing countries often rummage through any trash and garbage sites (kitchen foodstuffs) established by U.S. forces. Such activity promotes the spread of disease and injuries. It also compromises the integrity of our efforts to control pests and ensure the health and operational safety of U.S. soldiers. Compounding this problem are the environmental issues associated with spill prevention and the proper disposal of hazardous wastes. The wastes include batteries, antifreeze, solvents, flammables, POL, medical wastes, human wastes, and effluent from showers and laundry facilities.

RECOMMENDATION: Units deploying to developing countries must be prepared to address each of these environmental issues. Hazardous wastes can be containerized in 55-gallon drums, if available, or held for packaging, collection, and later evacuation. Medical wastes can be incinerated or autoclaved. Kitchen wastes can be minimized through the prudent use of a ration cycle that limits waste production. Human wastes can be buried or burned but must be carefully managed. The disposal method used will be determined by the force size, dispersion, environmental policy, and the availability of fixed or portable facilities. Shower and laundry effluent structures must be constructed to prevent pooling of "grey water" that can form pest breeding areas. The early deployment of heavy earthmoving equipment is vital to waste management. Also, dump sites may require full-time security.

Future articles in *ENGINEER* will present lessons learned at higher operational levels and joint operations. The likelihood of engineers participating in humanitarian assistance or peacekeeping missions is increasing. We hope these lessons learned help make your deployment smoother in every respect.

Major Brannon is an analyst in the Directorate of Standardization and Evaluation at the U.S. Army Engineer School. Previous assignments include platoon leader, DEH operations and executive officer, assistant S3, and company commander.

Mr. Lowrey is chief, Analysis Division, Directorate of Evaluation and Standardization, U.S. Army Engineer School. He was the engineer representative for the Center for Lessons Learned (CALL) team deployed to Somalia.

Engineer Problem

You are the construction officer for the 64th Combat Heavy Battalion, currently deployed to Somalia. Your battalion has received the mission to upgrade 40 general purpose (GP) medium tent frames to shelters that have corrugated metal roofing and screened window openings. The upgraded facilities will be used first as troop billets and then as housing for relief workers. The tent frames will be Army Facilities Components System (AFCS) Facility Number 72510AA, which are 16 feet by 32 feet.

To complete this mission, you must determine the following:

A. The AFCS facilities or subfacilities required.

B. The number of short tons of material needed for the total upgrade.

C. The number of man-hours required to construct each shelter.

References: TM 5-302, Volume 4, Chapter 4; TM 5-301-1; and TM 5-303.

ENGINEER Solution is on page 33.

Engineer, Bring Me a Map!

By Lieutenant Colonel Douglas Campbell

Engineers are experiencing many changes as the Army evolves to a smaller force. The well-publicized engineer restructure initiative has made restructure, reorganization, and deactivation the order of the day. A proposal currently under consideration at the Engineer School will reduce the number of engineer officer specialties by eliminating the topographic engineer specialty (21C).

The proposal supports the downsizing effort by reducing the number of engineer officer specialties from four to three, at a time when there are fewer engineer officers to go around. This course of action would require every engineer officer to be a topographic engineer, and every engineer would become, in effect, the commander's topographic support expert.

A Key Mission

This change would have an enormous impact because topographic engineers have a key role in a contingency army. For many years, the topographic community focused on strategic requirements and a few key geographic areas, such as Europe and Korea. Many maps exist for these familiar areas, but each new deployment to a place like Grenada, Somalia, or Southwest Asia sends the topographic community into a mad scramble to provide support.

It will take years for the Joint Chiefs of Staff and the Defense Mapping Agency (DMA) to shift from strategic support to conventional support in contingency areas. At the same time, the technology for

Mobility is more than just breaching and bridging. It's also keeping commanders off untrafficable ground.

Surveyors establish precise positions using GPS survey receivers.

providing topographic support is changing rapidly. Thus, engineer officers could be faced with the dual challenge of providing more topographic support to deployed forces and with maintaining technical competence as topographic engineers.

Although topographic support is an engineer responsibility, engineer officers have traditionally treated it as a separate specialty. In fact, topographic engineering was once a separate specialty (the 22 career field). Only a few engineers have filled topographic engineer positions. Of these, most have carried the 21C designation and have seldom served in other types of engineer assignments.

Most nontopographic engineers don't view this group as "real engineers" or "warfighters." This is partly deserved because many topographic engineers have failed to maintain tactical competence or focus and have totally immersed themselves in the technical aspects of their work. As a result, many topographic engineers have been of little value to commanders whose needs they don't understand. At the same time, many nontopographic engineers have failed to appreciate both the tactical significance of topographic support and the difficulties of providing that support. Thus, eliminating the separate topographic specialty would require a significant change in attitude in both camps. And "real engineers" (who already have a lot to do) would have to learn what engineers must be, know, and do to become the commander's topographic expert.

Topographic engineers perform several key functions, which translate into a list of subjects that every engineer must master. Engineer officers, from lieutenant through colonel, support combined arms commanders who must synchronize several battle operating systems (BOSs). Each echelon of engineers, then, must master all or part of that list if engineers are to accomplish the topographic support mission. This list falls into three major categories. Topographic engineers must—

- ***Understand the basics of mapping, charting, and geodesy (MC&G) support.*** They serve as the Army's member of the DOD team charged with providing this support to the entire armed forces. Put simply, commanders need maps, and topographic engineers make sure that they get them.
- ***Be terrain analysis experts.*** They work closely with combat engineers and military intelligence officers to provide terrain analysis support to tactical commanders on the AirLand Battlefield. Every BOS requires some form of topographic support.
- ***Maintain the technical expertise necessary to manage MC&G and terrain analysis support efforts.*** Not only must they understand those requirements; they must also know how to focus essential support as commanders synchronize the BOSs. This means that topographic engineers must have a warfighter's perspective to anticipate the tactical commander's terrain analysis requirements. They must also have the technical competence necessary to acquire that support in time for it to be of use to the commander.

MC&G Support

In the role of MC&G staff officer, topographic engineers advise commanders on BOS requirements, standard products, nonstandard support, and geodetic support.

BOS Requirements. Topographic engineers must know what MC&G support each BOS needs to operate and advise commanders on how to get that support. This implies that engineers must understand how other BOSs operate. The engineer lieutenant must know the company team commander's

Military Aspects of Terrain (OCOKA)	Elements of Terrain Information	Examples of Terrain Analysis Products
Observation and fields of fire	• Vegetation (summer and winter) • Surface configuration • Obstacles (micro relief) • Battlefield environmental effects on terrain • Urban areas	• Horizontal line-of-sight for direct-fire weapons and radar • Emplacement suitability and performance ratings for ground surveillance
Cover and concealment	• Vegetation (summer and winter) • Surface configuration • Battlefield environmental effects on terrain • Urban areas	• Potential cover from direct and indirect fire (good/fair/poor) • Potential concealment from horizontal and vertical observations (good/fair/poor)
Obstacles	• Vegetation (summer and winter) • Surface configuration • Drainage characteristics • Natural and man-made obstacles • Micro relief • Surface materials (wet and dry) • Urban areas	• Location of existing natural and man-made obstacles • Potential mobility on the battlefield, expressed as GO, SLOW-GO, and NO-GO for tracked and wheeled vehicles
Key terrain	• Urban areas • Lines of communication • Surface configuration • Drainage characteristics	• Location of key terrain features, both natural and man-made Examples are landslide areas, bridges, choke points, high ground, and key military installations
Avenues of approach	• Vegetation (summer and winter) • Urban areas • Surface configuration • Surface materials (wet and dry) • Drainage characteristics • Lines of communication	• Identification of areas where movement of friendly and enemy forces may occur • Speed prediction • Drop zones • Landing zones • Landing beaches • Nap of the earth navigation

business, the engineer captain must know the task force commander's business, and the field grade engineer must know the brigade and higher commanders' business.

This is not a new concept. Engineers have always needed this perspective to accomplish mobility, countermobility, and survivability support. In the future, however, they will need to develop additional appreciation for topographic requirements not directly associated with those engineer missions.

Standard Products. Topographic engineers must know every standard topographic product used to support their echelon of combined arms operations. They must fully understand the specifications, uses, and limitations of those products and how to acquire them. However, most engineer officers lack this basic knowledge.

For example, many don't realize that three versions of the standard military 1:250,000-scale map exist. The Joint Operations Graphic-Air (JOG-A) has contours in feet and elevation tinting. The Joint Operations Graphic-Ground (JOG-G) has elevations in meters and standard map colors. The Joint Operations Graphic-Radar (JOG-R) is another form with specific applications and different shading. All three are made from the same base map, and each has a specific use. Without such basic knowledge, engineers cannot function well in the topographic arena.

Nonstandard Support. Since a contingency force is likely to deploy to areas where standard products are not available, topographic engineers must know which nonstandard products they should expect. They must know what is available, the limitations for that support, and how to acquire it. They should be familiar with image-based map substitutes and understand the limitations of imagery. They need to know the characteristics and limitations of Landsat (multispectral scanner and thematic mapper), SPOT (a French satellite-imaging system), and other remote-sensing imagery.

Geodetic Support. Topographic engineers also need a grasp of some basic geodesy subjects. They must be able to use different coordinate systems, such as geographical versus universal transverse mercator (grid) (UTM) coordinates. They must also understand datums and coordinate transformations. Deploying forces will probably have nonstandard products generated from different datums and using different coordinate systems. Engineer officers must also be global positioning system (GPS) experts. As such, they must know the strengths and limitations of that system as well as how to navigate with it.

Terrain Analysis

Topographic engineers serve as commanders' terrain analysis experts. Terrain visualization, the essence of terrain analysis, is more than simply "seeing" the battlefield. It also involves interpreting the impact of what the commander sees on BOSs. To perform this role, topographic engineers must fully understand both tactical decision making and how to acquire the required terrain analysis support for the decision-making process.

Topographic engineers cannot anticipate commanders' needs for terrain information unless they become full participants in several critical processes:

- ***Intelligence preparation of the battlefield (IPB).*** Topographic engineers must be IPB experts. Terrain affects every BOS (enemy and friendly), and terrain analysis is a key step in IPB.
- ***Command estimate.*** Topographic engineers support the commander and staff as they develop and wargame friendly courses of action. They must fully understand the impacts of terrain on each course of action considered and provide the information needed to visualize that terrain influence before the wargaming process begins.
- ***Intelligence collection.*** Topographic engineers must advise commanders and intelligence officers (S2/G2) on terrain intelligence requirements as well as on which units should be tasked to collect that information.

Technical Proficiency

Engineers must also understand some technical aspects of topographic support, especially digital topographic support and existing support systems.

Digital Topographic Support. Many forms of topographic support are in digital form. Moreover, given the difficulties of map distribution, the future means of sharing topographic information will probably be based on one or more digital systems. To perform well in such an atmosphere, topographic engineers must be familiar with computer, collection, and data systems. They must understand what a geographical information system is, the concept of an integrated data base, and the implications of both of them for providing support to a contingency army. They must also understand the temporal nature of some topographic information—after all, engineers routinely alter the terrain.

Finally, topograpic engineers must know a data set's resolution (level of detail) and the accuracy associated with it. For example, many systems use digital terrain elevation data (DTED), which permits commanders to visualize the impact of terrain on operations. There are two levels of DTED, with level II providing a much finer resolution than level I. There are also several sources of DTED data. DMA manufactures most DTED from photogrammetric sources, but they have used less accurate cartographic sources in many areas.

Existing Support Systems. Topographic engineers must know how to use the TerraBase, TerraCAMMS, the battlefield planning system on the Maneuver Control System (MCS), the MCS-engineer software, and the analytical photogrammetric positioning system (APPS).

All engineers should know how to exploit topographic support elements. Terrain teams, surveyors, cartographic capabilities, and map reproduction capabilities are available throughout theaters. However, engineers must also know how map distribution should work and how to get special support to those who need it in time for that support to be useful.

The Road Map

So, how do engineers become topographic engineers? The Engineer School must first develop a training and education program to make every engineer a competent topographic engineer. Then, engineers need a mix of institutional training, operational assignments, and self-development to make the program work. But a cultural change is also required. Those who have been topographic engineers must develop a better warfighter perspective. In turn, warfighters must develop a topographic perspective.

To accomplish all this, the Engineer School needs a strategy or master plan for eliminating the 21C specialty. It should address four key areas: the topographic engineer task list, a developmental plan for that task list, key positions requiring special training, and assession standards for engineers.

The Task List. A system already in place articulates what an officer should be, know, and do—Military Qualification Standards (MQS). The Engineer School must develop for MQS a comprehensive set of topographic engineer tasks that spell out the required topographic skills. The task selection board should be balanced between topographic and nontopographic engineers.

A Development Plan. Next, the Engineer School must decide which mix of institutional training, operational assignments, and self-development is required for topographic engineer training. The Engineer Officer Basic and Advanced programs of instruction are already full. Consequently, operational assignments and self-development will be critical to a topographic engineer's development.

To avoid recreating a "de facto" topographic specialty, assignment officers at PERSCOM must ensure that they do not assign officers in back-to-back assignments dealing exclusively with topographic engineering. In addition, the Engineer School will have to ensure that materials are available to make self-development a practical reality.

Key Positions. The Engineer School and Engineer Branch must designate key topographic positions that require extra training and education. Officers in such positions would then attend either graduate school or a Defense Mapping School course en route to the assignment. These positions include joint MC&G staff jobs, Army Education Requirements Billets (AERBs) with DMA, and topographic engineer program managers in the Engineer School.

Assession Standards. Finally, the Engineer Branch needs to recruit new officers who already have engineering backgrounds. That would free a number of hours in basic and advanced courses now dedicated to engineering subjects for covering basic topographic subjects. Currently, many engineer officers in basic and advanced courses have neither the aptitude nor the inclination to perform relatively simple calculations, procedures, and analyses associated with construction engineering. If one engineer officer must be all engineers to all commanders, then the Engineer Branch must have a head start when new officers arrive. Like it or not, each future engineer officer will need to be much more a technician but no less a warrior.

GPS: The commander's new compass

Not Done Yet

Change for engineers is inevitable. The pressure to reduce the force, consolidate functions, and redefine roles will continue. Hopefully, the new Army will still get the quality of engineer support in all areas, including topographic engineering, that it deserves. Whether or not this happens will depend, in large part, on how well we tackle issues such as eliminating the topographic engineer specialty.

LTC Campbell currently serves as Chief, Engineer Officer Advanced Course Division, in the U.S. Army Engineer School's Department of Instruction.He has previously held several command and staff assignments, including several as a topographic engineer. A graduate of the Command and General Staff College, LTC Campbell holds a master of science degree in civil engineering from Virginia Technical Institute.

BCTP Perceptions

By Lieutenant Colonel Dan Collins and Major Jim Dumolt

As the Army continues to downsize and budgets are restrained, computer simulations become more important as a training tool. The Battle Command Training Program (BCTP) uses corps battle simulation (CBS) as a training framework to assist division and corps commanders in determining areas they should sustain and areas needing improvement. Annually, BCTP publishes what it perceives as trends (perceptions) across the Army. These are based on BCTP observations during the exercises they participate in throughout the year.

The Program

The U.S. Army has four combat training centers where soldiers train for future conflicts: the National Training Center at Fort Irwin, California; the Joint Readiness Training Center, currently at Fort Chaffee, Arkansas, but moving to Fort Polk, Louisiana; the Combat Maneuver Training Center at Hohenfels, Germany; and the BCTP at Fort Leavenworth, Kansas. The first three centers train combined arms brigades, battalions, and lower echelons of command using modern training scenarios and state-of-the-art training techniques and devices. BCTP, the capstone of these training centers, focuses on division- and corps-level operations.

A BCTP rotation has three components: a seminar, a warfighter exercise (WFX), and a proficiency sustainment package. Ideally, the intent of the program is to start the rotation within three to six months of a division's or corps' change of command. This allows a new commander to use the BCTP rotation to assess the level of training within his command and plan training for the remainder of his command tour.

The BCTP seminar usually is conducted at Fort Leavenworth; it involves the division or corps staff and a supporting battle staff. The purpose of the seminar is to review doctrine, review how the division or corps operates, and do team building. In many cases, this is the commander's first opportunity to have his subordinate commanders and staff collocated to focus on warfighting. He accomplishes this through two events. First, the commander and his staff are presented with tactical scenarios that require them to develop a division or corps plan and subsequent OPLAN, using the tactical decision-making process. The supporting battle staff performs a mission analysis, develops staff estimates, and generates and analyzes courses of action. The results of these processes are briefed to the commander several times during the week for his guidance or decision.

Once complete, the plan is fought on computer, using the CBS to resolve the conflicts and assess casualties and other losses. The simulation is run until a division- or corps-level decision point is reached; then the commander can alter the plan or continue to execute it as written. The battle staff briefs this decision point to the commander and primary staff in the form of an intelligence summary (INSUM) and an operations summary (OPSUM). The commander can then deliberate the alternatives with his major subordinate commanders (MSCs) and primary staff. Once the commander announces his decision, the simulation is continued for one more iteration, and the results are briefed to him the next day.

Summary of 1992 BCTP Perceptions

Mobility—Countermobility—Survivability

Obstacle control (including all FASCAM)

- Develop a concept to use and synchronize obstacles
- Develop a system to track friendly and enemy obstacles

Unclear engineer command and control functions and responsibilities

- Determine who controls current and future engineer operations
- Determine who controls sustainment operations

Habitual association: Pull units, using METT-T to support the main effort

Fortification: Estimate effort and protection accurately

Enemy obstacle and IR/PIR

- Template fire sacks
- Include threat engineer effort (MOD) in estimates

Resupply and movement of bridging, Class IV, and Engineer Class V: Track and plan, including basic loads and CSR

Second, the commander, his MSCs, and the primary staff attend a series of workshops that focus on doctrine and make leaders aware of current and emerging principles. The workshops and the planning process are designed to stimulate coaching, learning, and thinking. They forge the team that will perform these planning functions in the field during the warfighter.

The WFX is a training exercise that is scheduled three to six months after the seminar and is conducted at the unit's home station. It is a stressful exercise that "fights" the team developed at the seminar. The commander can use observations from the WFX to assess his unit's level of training. The WFX has several components:

- ***World class opposing forces.*** A thinking opponent who uses doctrinal tactics and equipment on a "level playing field" to provide feedback to the exercising unit.
- ***Observer/controllers.*** Military educational level-4 majors and lieutenant colonels who make observations during the WFX.
- ***Training standards.*** Standards described in field manuals and Army Training and Evaluation Programs.
- ***After action reviews.*** A forum to discuss what happened during the WFX and why it happened.
- ***Senior observers.*** Retired three and four star generals who provide feedback to observer controllers and the exercising unit.

Perceptions

Yearly, BCTP publishes what it has observed during WFXs in each of the seven battlefield operating systems. These perceptions are trends, not what BCTP observes during each WFX. Many units perform these perceptions well during a WFX. However, the following discussion focuses on areas that need improvement:

Obstacle control (including the entire family of scatterable mines (FASCAM))

Perception: Some units do not develop a concept to use and synchronize obstacles.

Discussion: In some cases, the commander's intent is not supported when obstacle placement and synchronization are compared with the modified combined obstacle overlay (MCOO) and obstacle zones. In some WFXs, the MCOO was not developed, and the obstacle zones were not used to shape the battlefield. When units did develop obstacle zones, a few placed individual obstacles outside these zones without permission from the division commander.

Perception: Units have problems when planning and tracking friendly obstacles.

Discussion: Divisions (heavy) typically try to post and track individual friendly obstacles rather than update obstacle zones by the percent complete and by discussing individual obstacles, when necessary. Corps, in general, do a good job in tracking ground-emplaced obstacles. Both divisions and corps on every warfighter have problems in either planning, executing, or tracking FASCAM, to include Gator. Scatterable mines have been planned outside obstacle zones without permission, and on unit objectives, thus placing units and mines at the same location at the same time. FASCAM/Gator missions were either executed and not requested, executed and not posted, or posted and not executed.

Engineer command and control functions and responsibilities

Perception: Units are not clear who controls current and future operations.

Discussions: The support an engineer unit provides during a WFX should be organized to match how the division or corps fights a battle. If the TAC fights the close battle, sufficient personnel should be at the TAC to do current operations, at the MAIN for future operations, and at the REAR to support sustainment operations. If the close battle and future planning are fought out of the MAIN, appropriate adjustments should be made.

Perception: Units have trouble controlling sustainment engineering.

Discussion: During all WFXs, units develop a sustainment plan. Few plans are executed as designed, and some are not executed at all. For example, units may not have a central collection point or a decision maker identified to prioritize and assign missions in the rear area of operation.

Habitual association

Perception: Units cannot overcome the habitual association and "fair share" to mass engineers using mission, enemy, terrain, troops, and time available (METT-T) to support the main effort.

Discussion: Divisions and corps rarely have enough engineers to accomplish every mission before and during combat operations. When doing a task organization to support the commander's intent using METT-T, the division or corps commander may have to pull units normally associated with a brigade or division to support the main effort.

Fortifications

Perception: Units rarely estimate how much effort they need to build a fortification and the protection it provides.

Discussion: This area improved throughout the year. Units do not accurately estimate the amount of material or time involved in building fortifications. Also, once the fortifications are built, units overestimate the amount of protection the fortifications provide. Units have expected engineers to dig-in all artillery and aviation units with overhead protection. All this was to be done in three days with Class IV material designed to support two-man fighting positions.

Enemy obstacles

Perception: Commanders do not consider enemy obstacles as an information requirement/priority intelligence requirement (IR/PIR).

Discussion: Because enemy obstacles are not an IR/PIR, maneuver units do not focus on locating and reporting them. With this information, units can better locate the first and second defensive belts and fire sacks. Without this information, brigades maneuver into kill sacks and are destroyed.

Resupply and movement of bridging, Class IV, and Class V

Perception: Units do not plan accurately for resupply and movement of bridging, Class IV, and engineer Class V.

Discussion: This area improved throughout the year. However, some units still do not adequately track and plan for the transport of Class IV and engineer Class V by line item.

Conclusion

Computer simulation will be a very important training tool as the Army continues to downsize and the focus shifts to a more refined fighting force. The BCTP will continue to use corps battle simulation as a training framework for commanders. Perceptions from past WFXs can help unit commanders focus their training efforts while maintaining a well-trained fighting force.

LTC Dan Collins is assigned as an observer/controller for the BCTP. Previous assignments included S3 for the 1st Brigade, Fort Leonard Wood, XO of the 2nd Engineer Battalion, Camp Casey, Korea, and of the 299th Engineer Battalion, Fort Sill, and chief of ground operations, Warrior Preparation Center, Einsidlerhof, Germany. LTC Collins is a graduate of the Command and General Staff College.

MAJ Jim Dumolt is assigned as an observer/controller for the BCTP. Previous assignments included assistant S3 for the 7th Engineer Brigade during Operation Desert Storm, S3 of the 78th Engineer Battalion in Karlsruhe, Germany, and brigade engineer in the 1st Armored Division. MAJ Dumolt is a graduate of the Command and General Staff College.

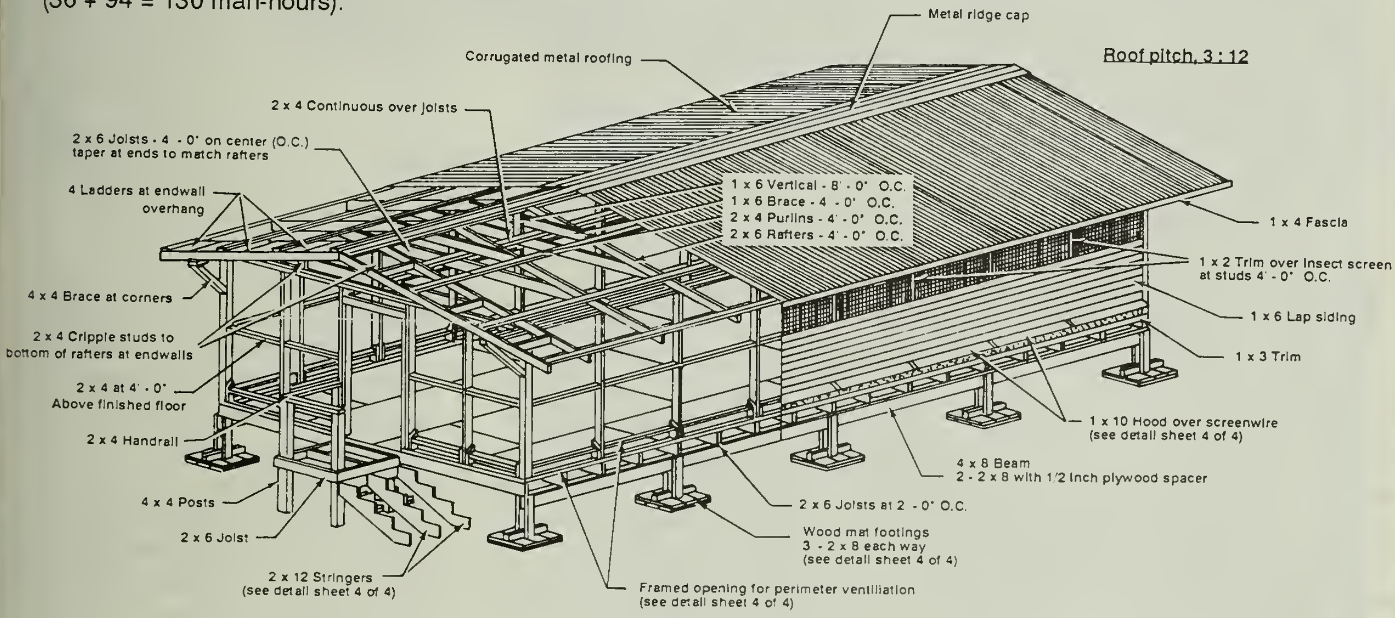
Engineer Solution

A. Using TM 5-302, Volume 4, you find that the upgrade requires AFCS subfacilities Nos. 72510AN and 72510AR. Because the 16 foot x 32 foot tent frame system (AFCS No. 72510AA) already exists, only an exterior wall extension and a roofing system are needed.

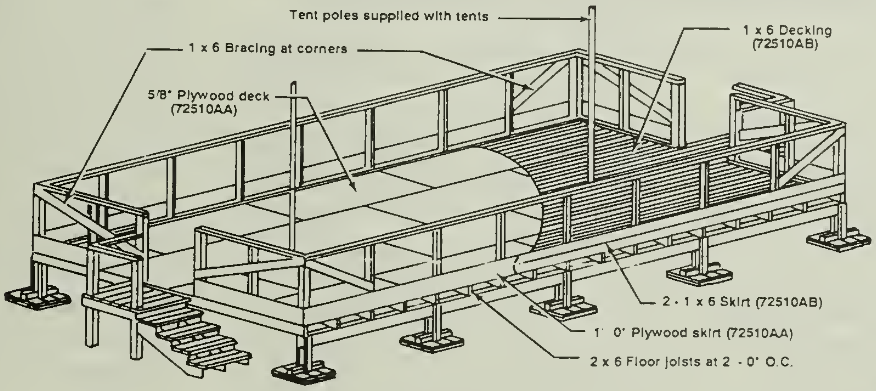
B. A total of 200 short tons is required to upgrade 40 shelters. Using page 108 of TM 5-301-1 and the facility planning tables, you determine that each wall extension requires 1 short ton and the roofing system requires 4 short tons. Multiply the sum of those two numbers by 40 to obtain the total quantity required (5 X 40 = 200 short tons).

TM 5-303 is used to determine the bill of materials (BOM) for this project.

C. One troop shelter requires 130 man-hours of construction effort. Again using page 108 of TM 5-301-1, you determine that it takes 36 man-hours to construct the wall systems and 94 man-hours to construct the roof system (36 + 94 = 130 man-hours).


Metal ridge cap
Roof pitch, 3 : 12
Corrugated metal roofing
2 x 4 Continuous over joists
2 x 6 Joists - 4 - 0' on center (O.C.) taper at ends to match rafters
4 Ladders at endwall overhang
4 x 4 Brace at corners
2 x 4 Cripple studs to bottom of rafters at endwalls
2 x 4 at 4' - 0' Above finished floor
2 x 4 Handrail
4 x 4 Posts
2 x 6 Joist
2 x 12 Stringers (see detail sheet 4 of 4)
1 x 6 Vertical - 8' - 0' O.C.
1 x 6 Brace - 4 - 0' O.C.
2 x 4 Purlins - 4' - 0' O.C.
2 x 6 Rafters - 4' - 0' O.C.
1 x 4 Fascia
1 x 2 Trim over insect screen at studs 4' - 0' O.C.
1 x 6 Lap siding
1 x 3 Trim
1 x 10 Hood over screenwire (see detail sheet 4 of 4)
4 x 8 Beam
2 - 2 x 8 with 1/2 inch plywood spacer
2 x 6 Joists at 2 - 0' O.C.
Wood mat footings
3 - 2 x 8 each way
(see detail sheet 4 of 4)
Framed opening for perimeter ventilation (see detail sheet 4 of 4)

General Purpose Troop Shelter
Isometric View


Tent poles supplied with tents
1 x 6 Bracing at corners
5/8" Plywood deck (72510AA)
1 x 6 Decking (72510AB)
2 - 1 x 6 Skirt (72510AB)
1' 0" Plywood skirt (72510AA)
2 x 6 Floor joists at 2 - 0' O.C.

Tent Frame
Facility No. 72510AA - AB

This ENGINEER Problem/Solution was submitted by the Combat Construction Division, Department of Instruction, U.S. Army Engineer School.

Bridge from the Sky:

Airdropping the MGB

By Captain Dave Anderson

The medium girder bridge (MGB), a standard fixed bridge originally designed to be truck-transported, recently proved itself to be far more versatile. In February 1992, the 264th Engineer Company (MGB) wrote a new chapter for MGB delivery by conducting the first-ever airborne insertion of the bridge system.

The Airdrop Concept

The concept for airdropping fixed bridges was developed in the early 1960s in Germany. At that time, the 8th Infantry Division (Mechanized) had one airborne brigade. It was supported by A Company, 12th Engineer Battalion, also airborne but with a mechanized table of organization and equipment.

Captain Scott Smith (now Major General, retired) and First Lieutenant Bob Howard (now Brigadier General Howard) developed a concept for airdropping a 38-foot 4-inch configuration of an M4T6 fixed-span bridge. Such a method was needed to provide fixed-bridge support to isolated units or those cut off from conventional bridge support. The operational concept was validated when the airborne/mechanized engineer company successfully conducted an airdrop of the palletized bridge in 1965. Although successful, the airdrop technique was not used during the Vietnam war. In that conflict, bridges frequently were sling-loaded below heavy lift helicopters and delivered exactly where they were needed.

While reviewing wartime contingency plans in the mid-1980s, the 20th Engineer Brigade (Combat)(Airborne Corps), Fort Bragg, North Carolina, again recognized the need for an airdroppable bridge package. War planners realized that if a maneuver force became isolated by the enemy or the terrain, it would be essential to support them with bridge assets. By that time, the MGB had replaced the M4T6 and the Bailey bridge as the Army's primary fixed bridge.

The 20th started action to certify the MGB for an airdrop—a technique that had never been tested with the MGB. The U.S. Army Airborne and Special Operations Test Board and the U.S. Air Force standardized how the equipment would be configured and rigged to remain stable in flight and to land intact after the parachutes were deployed. The MGB airdrop tests conducted in 1989 at Fort Bragg were successful, and the certification process was complete.

The first operational airdrop of the MGB package was delayed because the 264th had deployed to Operations Desert Shield and Desert Storm and airborne-qualified bridge crewmen were not available. By February 1992, the 264th had 30 percent of its soldiers on jump status and was ready to conduct an airborne bridge mission. Their "opportunity to excel" came when the 20th Engineer Brigade directed an emergency deployment readiness exercise (EDRE).

The First MGB Airdrop

In the EDRE scenario, the 264th was attached to the 27th Engineer Battalion

(Combat) (Airborne) for a humanitarian relief operation. The task force was to deploy notionally to central Mexico (actually the Rhine-Luzon Drop Zone at Camp Mackall, North Carolina). Their mission was to provide initial engineering support to a small town that had been devastated by an earthquake. The airport that serviced the town had been badly damaged, and bridges over the river that separated the town from the airport had been destroyed. The task force was to conduct an airborne insertion onto the airfield, repair it, and construct an MGB across the river so follow-on forces could land and access the town.

The 264th received its warning order at 1600 hours, 25 February 1992. One M817 5-ton dump truck, one 7 1/2-ton rough-terrain crane, one M998 HMMWV, and one 7-bay single-story MGB were to be air-dropped in the mission. Two 5-ton trucks were pre-positioned at the drop zone instead of air-dropped because the number of available aircraft was limited. Fourteen airborne bridge crewmen would deploy with the equipment. Time on target was 1300 to 1330 hours, 27 February, 45 hours after the warning order was received. For a "no-notice," airdrop mission, 45 hours does not allow for any wasted moments.

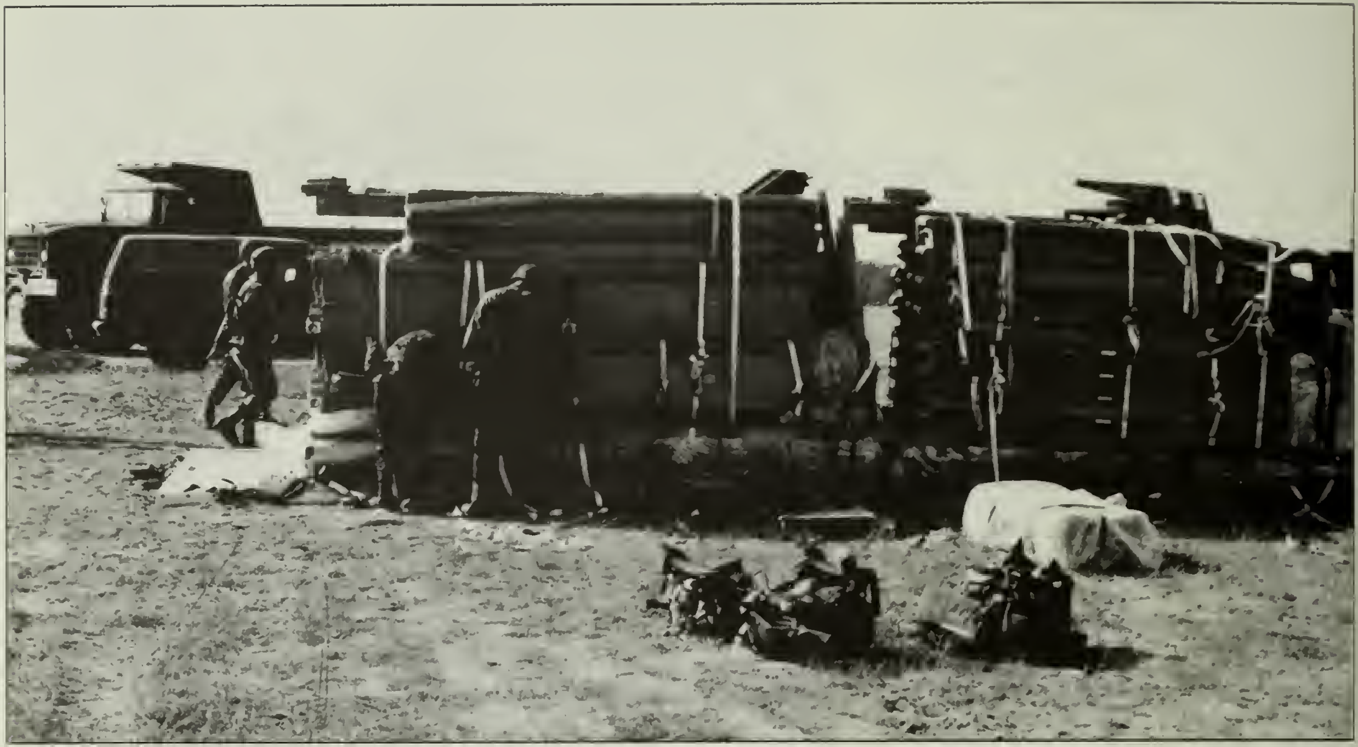
A pallet of bridge equipment descends onto the Rhine-Luzon drop zone.

Troop loading procedures began immediately. First the vehicles and equipment were inventoried and prepared for the mission. The "headache board", cab canvas, and exhaust stack were removed from the 5-ton dump truck. The canvas was removed from the HMMWV and ballast added to the back of the HMMWV for proper balance during the drop. Paratroopers were identified, and support crews were organized to assist in rigging the equipment for an airdrop.

The warning order called for the equipment and vehicles to be at the 612th Quartermaster Company for rigging by 0630 hours, 26 February. Rigging the vehicles and equipment took all day but the process went well. By the time the operations order was published and N-hour was announced, the equipment had been weighed, rigged, and delivered to "Green Ramp" at Pope Air Force Base. There it was inspected by Air Force personnel before being loaded on the aircraft.

Personnel involved in the mission went through the preparation of replacements for overseas movement routine and were then attached to the 27th for the mission. The paratroopers' equipment was rigged, inspected, and reinspected. At 2200 hours, the operations order was briefed to the company. There was nothing left to do but provide liaison to the 27th and wait.

Prejump manifest and training, standard for all airborne operations, went smoothly. By 1200 hours, 27 February, the bridge crewmen and their officers were boarding a C-141 "Starlifter" notionally bound for central Mexico.



Derigging the bridge at the drop zone.

The equipment, which preceded the personnel onto the drop zone, encountered a few problems during the airdrop. The dump truck sustained some damage to its front end, but it was still operational for the exercise. The 7 1/2-ton crane missed its mark and landed in a pine forest. Driving the crane out of the forest was an environmentally sensitive project because the trees were near the habitat and nesting area of the endangered Red Cockaded Woodpecker.

The paratroopers jumped into the fictitious central Mexico after 1 hour of low-level flight. Following assembly procedures, half of the airborne bridge crewmen of the 264th derigged the bridge equipment, dump truck, and HMMWV. The rest did a reconnaissance of the bridge site and prepared it for bridge construction.

The crane's faulty landing delayed the operation because soldiers could not load the pallets until they derigged the crane and drove it out of the pine forest. Once the crane was freed, soldiers loaded the pallet containing the end of bridge on the dump truck and delivered it to the bridge site. Construction began immediately. The soldiers returned the dump truck to the drop zone and retrieved the second pallet of bridge equipment. Traffic started passing over the bridge about 1 1/2 hours after construction began. Assuming a 5-hour flight to central Mexico and 2 hours to derig equipment, the 264th determined that relief packages could have reached the disaster-stricken city only 8 1/2 hours after the initial force left Fort Bragg. Such a quick response time translates into lives saved, whether in combat or in a disaster-relief scenario.

Concept Validation

The success of the exercise validated airborne delivery as a new means of getting the MGB to the battlefield. It also ushered in a new age for the 264th Engineer Company (MGB) as the only airborne bridge company in the Army. The airborne MBG concept was further validated during a corps-level command-post exercise in March 1992. The deputy commanding general of the XVIII Airborne Corps called for and received an airborne-delivered MGB as part of the command-post exercise. The capability is there, and the corps is ready and willing to use it. The MGB again showed that its capabilities are only limited by the imagination of those using it.

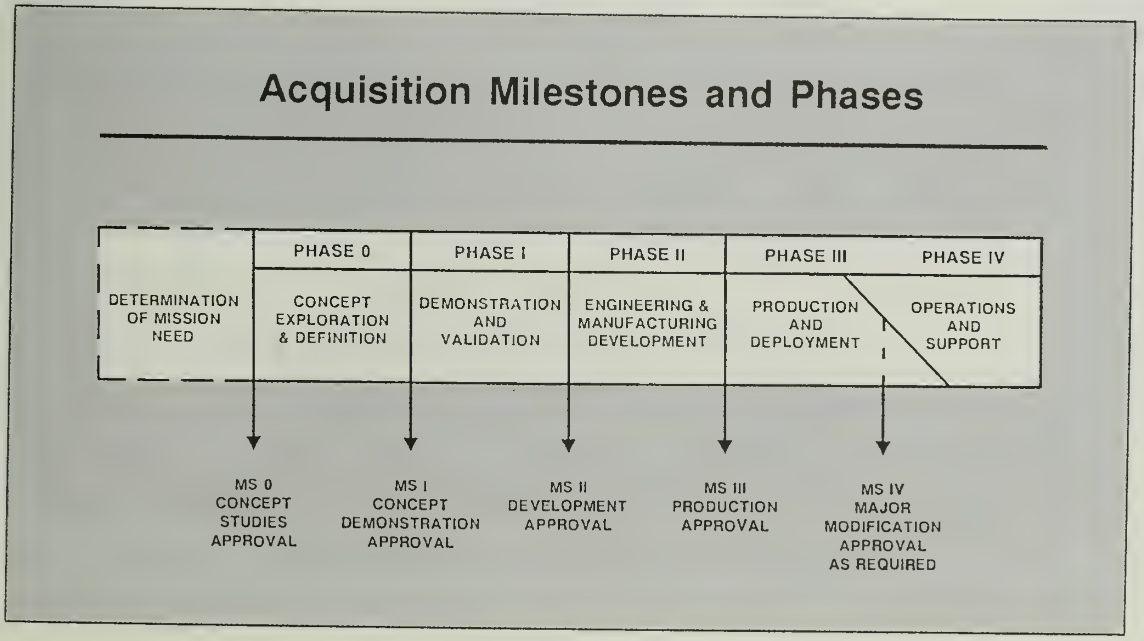
CPT Anderson is the commander of the 264th Engineer Company (MGB), 20th Engineer Brigade (Combat) (Airborne Corps), Fort Bragg, NC. He previously served as a platoon leader, XO, and adjutant in the 17th Engineer Battalion, 2d Armored Division, Fort Hood, Texas, and as a battalion staff officer in the 30th Engineer Battalion, Fort Bragg.

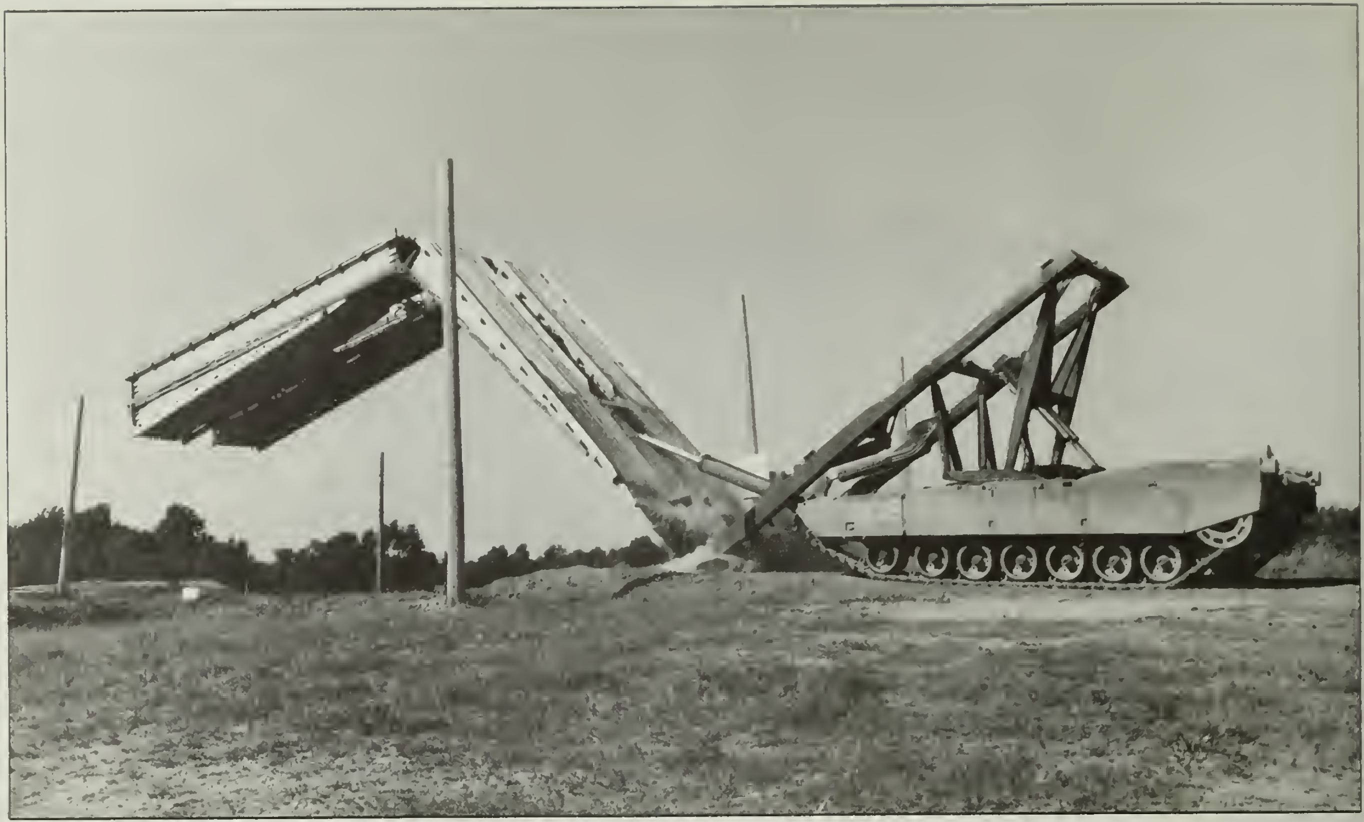
OPERATIONAL TESTING AND EVALUATION OF ENGINEER SYSTEMS

By Major Richard J. Mally

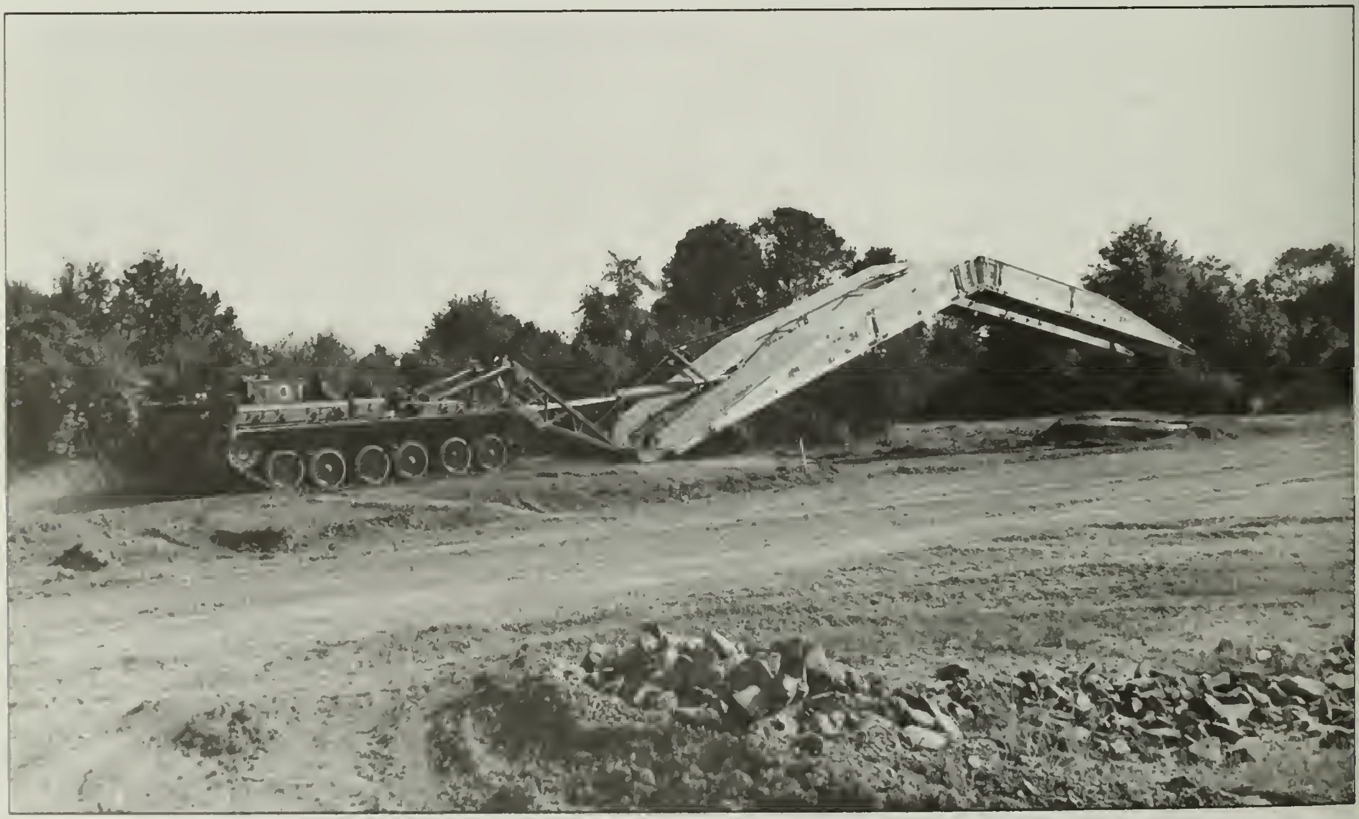
Operations Desert Storm, Provide Comfort, and Restore Hope, provide vivid examples of the agility, lethality, and versatility that the Army must have to meet the challenges of today and tomorrow. These operations illustrate the diverse conditions under which engineers and their equipment must be able to maneuver, survive, and be logistically supported. Because of such diverse requirements and reduced budgets for new systems acquisition, each new piece of equipment fielded by the engineers must be proven operationally effective and suitable before it is fielded.

This article is an overview of operational testing and evaluation (OT&E) in the Army, as applied specifically to engineer systems. Currently, about 60 engineer systems are undergoing development, production, or fielding. Most of them are nondevelopmental systems, which are commercial systems with little or no modification. They are purchased for military applications at a lower overall cost than items that require several years to develop and refine. All systems purchased by the Army undergo an in-depth operational assessment to ensure

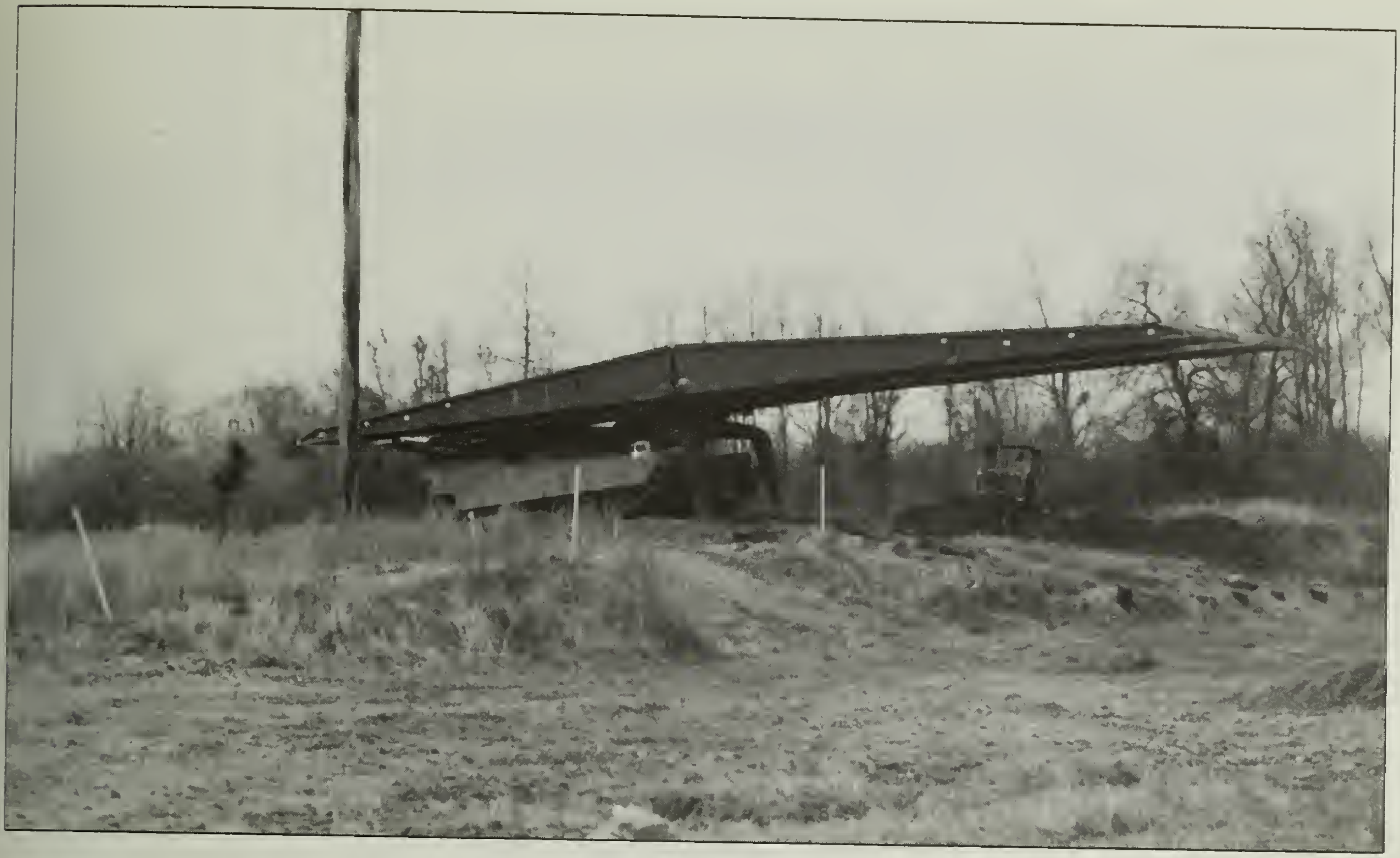

Acquisition Milestones and Phases
DETERMINATION OF MISSION NEED
PHASE 0
CONCEPT EXPLORATION & DEFINITION
PHASE I
DEMONSTRATION AND VALIDATION
PHASE II
ENGINEERING & MANUFACTURING DEVELOPMENT
PHASE III
PRODUCTION AND DEPLOYMENT
PHASE IV
OPERATIONS AND SUPPORT
MS 0 CONCEPT STUDIES APPROVAL
MS I CONCEPT DEMONSTRATION APPROVAL
MS II DEVELOPMENT APPROVAL
MS III PRODUCTION APPROVAL
MS IV MAJOR MODIFICATION APPROVAL AS REQUIRED



Double-Fold Scissor Bridge (Scissors) by BMY/IMI



Christchurch Tank Bridge (No. 10) by SMS/TDP



Horizontal Launched Bridge (Leguan) by GDLS/MAN

that they are capable of performing effectively, in an operational environment, with typical users—soldiers.

The U.S. Army Operational Test and Evaluation Command (OPTEC) in Alexandria, Virginia, is responsible for OT&E of Army systems. Its two subordinate commands, the Test and Experimentation Command (TEXCOM), Fort Hood, Texas, and the Operational Evaluation Command (OEC), Alexandria, Virginia, conduct the operational testing and independent evaluation, respectively.

Why Testing and Evaluation are Performed

The acquisition of a new system generally occurs in five phases. The chart on page 37 shows a generic acquisition model covering the full life cycle of a system. Each phase starts with a decision (milestone), where the status of the program progress is reviewed to determine whether the program is to proceed as planned, be revised, or be terminated. OT&E is conducted to support each decision point. In this way, programs that fail to achieve expected results can be redirected or terminated before fielding, thus saving time and money. If a system performs as required, OT&E provides the Army, and ultimately the soldier, the assurance that this new equipment, with its logistical support, software, training plan, tactics and doctrine of employment, will function well.

Several engineer systems are currently in a phase of the acquisition process that requires operational assessments to support key Army decisions. The following examples of recent testing illustrate a variety of approaches to OT&E and demonstrate the need for flexible and innovative testing and evaluation strategies.

Heavy Assault Bridge (HAB). Desert Storm confirmed the need for a dependable HAB that could maintain the pace of a maneuver force made up of M1 tanks and M2 fighting vehicles. The current armored vehicle launched bridge (AVLB) is outdated and incapable of supporting today's heavy force. After Desert Storm, the HAB program was revised, and testing to support an Army decision for the best bridge design is now almost complete.

The HAB is a 26-meter, military load class (MLC) 70 bridge that is mounted on an M1 Abrams tank chassis. Capable of spanning gaps up to 24 meters on both prepared and unprepared abutments, the HAB will replace the current MLC 60 AVLB on a one-for-one basis. Three systems are currently competing for best bridge design: the double-fold scissors bridge

The Improved Ribbon Bridge (IRB)

(Scissors), by BMY/IMI; the horizontal launched bridge (Leguan), by GDLS/MAN; and the Christchurch No. 10 tank bridge, a two-piece cable scissors bridge (No. 10), by SMS/TDP.

To test each system and support the selection process, a combined technical and operational test was scheduled to take place at Aberdeen Proving Ground, Maryland (APG). The photographs on pages 38-39 show the three design systems under consideration when they were tested at APG. Each system would be tested side-by-side, under the same conditions, to ensure performance assessments were measured against a standard set of environmental and test conditions. The T&E objective was to evaluate only the bridges and launch mechanisms; chassis performance was not a consideration. The combined testing strategy was designed to use data from both the operational and technical portions of the test to assess the operational performance. The operational test portion was intended to provide the majority of data pertaining to launch and retrieval missions and heavy vehicle crossings.

This plan was determined adequate to assess the potential of each system. However, unexpected system failures occurred during the technical portion and the T&E strategy had to be restructured. The operational portion of the test was cancelled and the technical portion was expanded to include six assault crossing missions, one of which was at night in adverse weather conditions. This flexibility produced the necessary data to support source selection and assess the potential operational capability of the systems.

Cancelling the operational test added risk to the HAB program, but the risk will be managed through an aggressive T&E plan to ensure that a quality system is produced before fielding. The next HAB operational test is planned for late 1995. It will evaluate the overall operational capability of the selected design after it has been integrated with the refurbished Abrams chassis. The test will be used to determine whether the HAB is ready for production.

The Improved Ribbon Bridge (IRB). The IRB program was initiated in March 1985, when the Army approved the acquisition of a bridge that could cross heavy traffic (MLC 70). The acquisition strategy called for evaluating two candidate systems against approved requirements. A combined technical and operational test strategy was developed to support the acquisition. This strategy resulted in reductions in overall test cost, program schedule time, and test resources, and it eliminated redundant data requirements. The operational portion of the test was designed to obtain data on both candidate systems while each was operated and maintained by soldiers in a realistic environment.

Initial testing was conducted at Aberdeen Proving Ground in July-August 1991 to gather data on the physical characteristics of each bridge system and to ensure the systems were safe before soldiers used them. Then, all test items and test support equipment were transported to Fort Chaffee, Arkansas for operational testing. Conditions at Fort Chaffee and the Arkansas River are similar to those in Europe and are ideal for conducting bridging and rafting operations.

TEXCOM conducted the operational test from September to November 1991. Soldiers from the 902d Assault Ribbon Bridge Company, Fort Leonard Wood, Missouri, operated and maintained both systems during the test. The 902d's participation was unprecedented; never before had an entire unit been deployed to participate in testing an engineer system. The expertise and leadership of the officers and NCOs contributed significantly to a successful evaluation in "real world" conditions.

The Army acquisition strategy for the IRB was restructured because of funding cuts. The Army decided that the available funds would be used to procure the best transporter mechanism to use with the M977 heavy expanded mobility tactical truck (HEMTT). They are used to transport and launch the current bridge system. The second phase of technical testing, currently concluding at APG, was tailored to support evaluation of the two transporter mechanisms. The test featured about 1,380 launch and retrieval cycles with each system. It was designed to determine performance compatibility with fielded ribbon bridge equipment and the operational capability of each system to meet the Army requirement.

After the system is selected and integrated with the HEMTT, it will be subjected to another technical and operational test and evaluation, from August to November 1994. Test results will provide Army decision makers the means to determine if the system is ready to go into full production.

Regardless of the cost or complexity of the engineer systems procured, the equipment must meet its operational requirements and be deployable on short notice.

The Digital Topographic Support System (DTSS). The DTSS is a tactical, computer-based system that will provide automated support to the Army's terrain analysts. It will be able to receive and process high-density, digital terrain data produced by the Defense Mapping Agency. This data will be used to produce terrain analysis products used in the intelligence preparation of the battlefield (IPB). The DTSS is to be compatible with other tactical systems that provide terrain data and products.

A technical test in 1991 provided performance information for a special program review in January 1992 to authorize a low-rate initial production (LRIP) of seven DTSS units. These units supported an OT&E conducted at Fort Hood from April to July 1992. The operational test was conducted using three terrain teams that operated the DTSS systems during six 96-hour wartime scenarios. Each team consisted of personnel of the same rank and MOS from units that will receive the DTSS when it is fielded. These teams conducted a variety of terrain analysis missions at division, corps, and echelons above corps levels. The test data will be used to develop an operational assessment in support of a full-rate production decision.

The DTSS acquisition program is structured in a fashion unlike most engineer systems. DTSS will have three iterations of upgrades, called preplanned product improvements (P3I), applied to the initial configuration and capability. The P3I are scheduled to be implemented as Blocks I, II, and III, beginning in FY 93, with completion scheduled for FY 97.

While some of the improvements will require only limited testing to support an assessment of operational effectiveness and suitability, others may require more extensive testing. One P3I that could require significant additional testing calls for a reduction in system size to accommodate driving on and off C-130 and C-141 aircraft. This transportability improvement is needed to support fielding of the DTSS to the light divisions.

The Earth Auger. Only limited testing will be used to evaluate the operational effectiveness and suitability of the earth auger for the small emplacement excavator (SEE). The auger attachment is a commercially available item that will adapt to the SEE, in place of the backhoe, without modification. Testing at the manufacturer's facility, with government representatives present, will verify the technical performance requirements.

An operational demonstration will be conducted at the conclusion of the technical test. The demonstration is scheduled to take place at Fort Leonard Wood in late 1993 or early 1994. It will provide data on the auger's performance when operated and maintained by soldiers; they will receive training, technical manuals, and repair parts needed to support fielding the system. An operational assessment will be made based on the results of the demonstration to support a fielding decision.

Conclusion

As the Army replaces outdated engineer systems with state-of-the-art systems, the need to validate system operational capability will be increasingly important. Regardless of the cost or complexity of the engineer systems procured, the equipment must meet its operational requirements and be deployable on short notice. Assessing the systems' operational capabilities must include using economical methods that do not jeopardize the purpose of independent operational assessments. The type and scope of testing will vary, but the approach must be flexible enough to support the acquisition strategy and to accommodate inevitable changes. Testing and evaluation remain essential to ensure that soldiers receive the operationally effective and suitable equipment that provides them an edge on tomorrow's battlefield.

Major Richard Mally is an independent operational evaluator for engineer systems in the U.S. Army Operational Evaluation Command. He previously served in the project manager office for Commercial Construction Equipment/Material Handling Equipment. He holds a master of business administration degree and a master of science degree in contract and acquisition management. He is a graduate of the Program Management Course, Defense Systems Management College.

(Personal Viewpoint, continued)

the TOW offsets the price paid by reducing the size of the dismounted element to five.

Some will argue that the Bradley is too small to carry an engineer squad and their pioneer tools inside. The engineer squad has eight personnel compared with nine in the infantry squad. The tools could be placed forward in the space occupied by the additional infantry soldier or affixed to the exterior of the vehicle. Such a simple design problem surely can be overcome.

Others are concerned about the gunnery requirement associated with the Bradley's 25mm gun and the TOW. While these systems do carry an additional gunnery requirement, their compatibility with the maneuver battalion makes it feasible to integrate engineers into the maneuver battalion's gunnery exercise.

The Bradley also provides the engineers an increased ability to see the battlefield. The integrated sight unit's thermal capability enables the gunner and Bradley commander to see during almost any visibility conditions. Prior to the Bradley, mechanized engineers and infantry fought from the same platform, the M113. If it was right then, is it wrong today? I think not.

Additionally, replacing the CEV with the M1 with mine plow will enable engineers to increase their contribution to countermine operations. The equipment currently in the mechanized engineer company contributes very little, as previously indicated.

Colonel Jack O'Neill states in the February 1993 issue of *ENGINEER* (page 9) that the 24th Infantry Division strongly endorses replacing the CEV with the M1 with plow. He points to the increased accuracy of the M1's main gun, better readiness rating, the ability to achieve the same destructive effects of the CEV's 165mm gun by multiple firings of the M1's high explosive AT rounds on a target, and better countermine capabilities. Units not yet equipped with ACEs are no doubt concerned about the absence of an earthmoving blade on the M1. This deficiency could be overcome by modifying the MTOE to include a combination of ACEs and dozers in heavy engineer companies. The 3rd Armored Division has already proposed this solution.

An engineer unit with M1s and M2s will dictate that engineer staffs become capable planners, competent tacticians, and prime-time players on the combined arms team.

Divisional engineer battalions currently have a maintenance section that cannot adequately support the battalion. The M1 and M2 platforms would justify maintenance sections comparable with those in Bradley-equipped infantry battalions. Thus, parts and technical expertise in the supported maneuver battalion's maintenance collection point would be more readily available. As the infantry replaces the ITV with the Bradley and air defense artillery moves toward the Bradley platform and away from the M113 family of vehicles, the M113 will become a lower density vehicle. Engineers must not be the last element in the force structure with the M113, as we were with the M60 chassis.

Acquisition Opportunity

We must configure our organization to maximize all available assets. We must not daydream about equipment on the drawing board, and we cannot afford to wait! As the Army downsizes, we must seize the initiative and acquire the M1s and M2s from deactivated infantry and armored units. An opportunity once passed may not come again.

LTC West is the senior engineer trainer at the National Training Center. His divisional experience includes company command in the 2nd Engineer Battalion, 2nd Infantry Division, and company command and battalion S3 in the 3rd Engineer Battalion, 24th Infantry Division.

ENGINEER UPDATE

Commercial numbers are (314) 563-XXXX and Defense System Network (DSN) numbers are 676-XXXX unless otherwise noted.

Directorate of Training and Doctrine (DOTD)

Engineer Photographs Requested. Donations of photographs and 35mm slides depicting U.S. Army engineer activities are requested for use in engineer media products. The Engineer School is seeking photographs or 35mm slides showing Army engineers or engineer activities in Vietnam, Panama, Grenada, Honduras, and Desert Storm. Donations should include a description of the photo location, date, and events depicted. The slides and photos will not be returned. Submit donations with a letter or note giving the Engineer School ownership and full use to: Commandant, U.S. Army Engineer School, Attn: ATSE-TDS, Fort Leonard Wood, Missouri 65473-6650. POC is Dave Shafer, -7749.

Directorate of Combat Developments (DCD)

CEV Turret Mechanic (MOS 45N) Recoded. As directed by HQDA, all positions in modified tables of organization and equipment (MTOE) and tables of distribution and allowances (TDA) coded as MOS 45N and associated with AVLB and CEV armored equipment must be recoded. The new codes will be MOS 45E, M1 Turret Mechanic; 45K, Armament Repairer; or 45T, M2 Turret Mechanic. MOS 45E is the preferred replacement. MOS 45N now applies only to reserve forces. To adjust the MTOE or TDA, engineer units must coordinate with the installation Directorate of Resource Management or Force Modernization Office. Guidance is provided in Table B-3, DA Circular 611-91-2, dated 1 October 1991. POC is Alan Schlie, -7357.

Engineer Systems Handbook. The April 1993 Engineer Systems Handbook is scheduled for distribution in May 1993. The handbook provides a description and status for fielded and developmental engineer systems. To obtain copies, write to: U.S. Army Engineer School, Attn: ATSE-CDP (Michael Fowler), Fort Leonard Wood, MO 65473. POC is Mike Fowler, -7301.

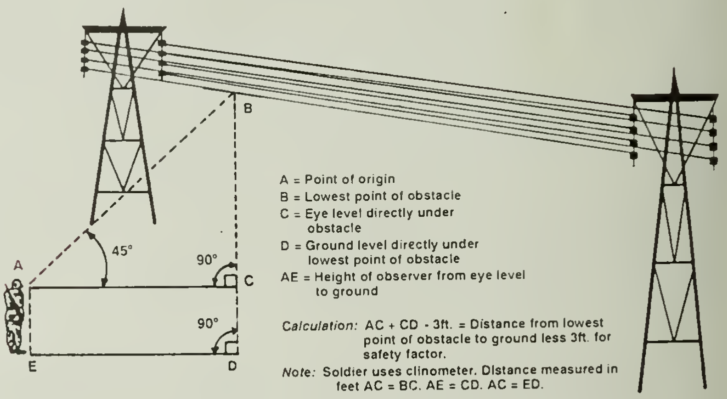
Directorate of Evaluation and Standardization (DOES)

Total Engineer Force Readiness. Battalion commanders are urged to support the Commandant's program of monitoring engineer force readiness by sending us a copy of the unclassified cover letter from monthly DA Forms 2406 (USR). These vital readiness issues become a powerful force when collected; they are used to support your needs at TRADOC, FORSCOM and AMC. Send letters to: U.S. Army Engineer School, Attn: ATSE-ESA, Fort Leonard Wood, MO 65473-6650. POC is Vern Lowrey, -5304.

Academic Records for Reserve Component Engineer Officers. Reserve Component engineer officers may call this office to verify their status on remaining course requirements. For information regarding EOAC-RC, call PFC Smith, -5293; for information regarding EOBC-RC, call SPC Tate, -5294.

Engineer Branch Safety Office (EBSO)

Accident Fatality. Failure to follow proper established procedures resulted in a fatal accident recently when a soldier used a metal tape to directly measure the height of electric power lines. The triangulation method taught in the Engineer School utilizes a Transit, Pocket Clinometer, LIN #X11320, NSN 6675-00-641-5735, to measure a 45-degree angle (see sketch). Distance AC + CD - 3 feet = the height to lowest point of obstacle, less 3 feet for safety. This method will be included in the new FM 5-170, *Engineer Reconnaissance,* which is scheduled for publication in the 4th quarter, FY 93. POC is Paul Rusinko, -5008.



A = Point of origin
B = Lowest point of obstacle
C = Eye level directly under obstacle
D = Ground level directly under lowest point of obstacle
AE = Height of observer from eye level to ground

Calculation: AC + CD - 3ft. = Distance from lowest point of obstacle to ground less 3ft. for safety factor.

Note: Soldier uses clinometer. Distance measured in feet AC = BC. AE = CD. AC = ED.

Reserve Component (RC)

Engineer Officer Basic Course-Reserve Component (EOBC-RC). Army National Guard (ARNG) officers must complete the correspondence phase of EOBC-RC before they attend Phase II (8-week resident phase). **The Engineer School will not allow officers to attend the resident phase without completion of the correspondence phase.** Officers who arrive at Fort Leonard Wood to attend Phase II without having completed Phase I will be returned to their state. POC is LTC Juneau, -7742.

Engineer Officer Advanced Course-Reserve Component (EOAC-RC):

- Effective 1 October 92, officers wishing to complete EOAC-RC must enroll in a new two-phase course. Phase

I consists of 208 hours of correspondence studies managed by the Army Correspondence Course Program (ACCP). It is available for distribution. To enroll, students must forward a completed DA Form 145, *Army Correspondence Course Enrollment Application*, through their unit training officer, to the Army Institute for Professional Development, Newport News, VA 23628-0001. This phase is a prerequisite to enrollment in Phase II. Phase II is a 2-week resident course that will be conducted by the Engineer School at Fort Leonard Wood. It will be offered for the first time early in 1994. The schedule for Phase II will be listed on the Army Training Requirements and Resources System (ATRRS).

- Confusion exists regarding the two resident EOAC courses offered by the Engineer School. One is the regular active duty 20-week advanced course (EOAC), which is required for all AGR officers. The other is the RC 14-week advanced course (EOAC-RC), which is open to M-Day soldiers and full-time technicians. Most RC officers should enroll in the 14-week course; they do not need the 20-week program. To avoid confusion, RC training officers and NCOs must ensure that their officers are informed about the two EOAC courses offered at the Engineer School. Effective 1 March 93, students arriving at Fort Leonard Wood with permanent change of station (PCS) orders for the 20-week active duty EOAC, cannot have their orders changed to temporary duty (TDY) to allow attendance at the 14-week EOAC-RC. The Defense Finance and Accounting System has ruled this is not permitted by regulation. POCs are COL Colcol, DAC-USAR, -6336; and LTC Juneau, DAC-ARNG, -7742.

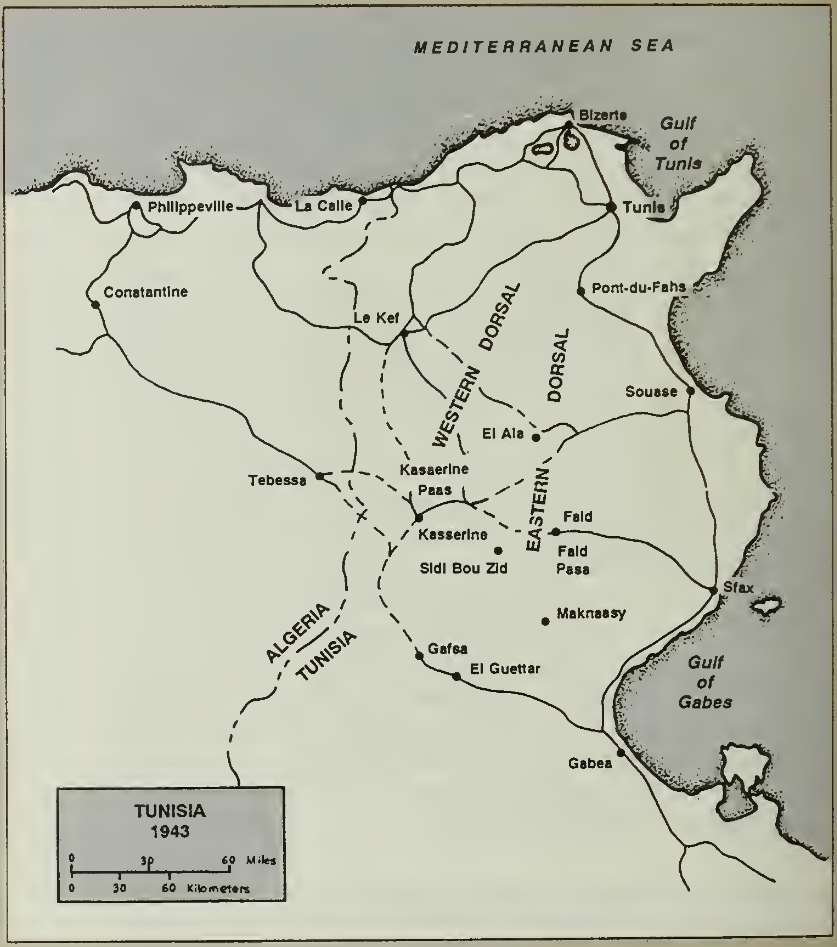
Engineer Refresher Courses Cancelled. Engineer refresher courses, including weekend classes and the 1-week Staff Refresher Course, have been cancelled. They will no longer be conducted at the Engineer School. POC is Cathy Holland, -6336/7742.

Unit Patches for 18th Engineer Brigade. Soldiers who served in the 18th Engineer Brigade can obtain unit patches, both color and subdued, by sending a self-addressed, stamped envelope to: CPT R. L. Shelton, 565th Engineer Battalion, Unit 31117, Box 35-93, APO AE 09164. The 18th Engineer Brigade, which deactivated in October 1992, served in Vietnam and during Operation Provide Comfort, in Turkey and Iraq.

Engineers in North Africa

By Dr. James W. Dunn

United States Army engineers experienced their first European combat in World War II in North Africa. During the Tunisian campaign, which lasted from November 1942 until May 1943, Army engineers executed their primary missions of road maintenance and mine warfare, as well as their secondary mission of fighting as infantry. They also completed two new missions by functioning as amphibian engineers and aviation engineers.



Operation Torch

Operation Torch, the Allied invasion of French North Africa, began November 8, 1942, when three division-sized task forces landed simultaneously at Algiers, Oran, and Casablanca. At all three sites, a company from the division engineer battalion was attached to each regimental landing team.

As amphibian engineers, the 36th Engineer Combat Regiment provided shore parties for the Eastern Task Force, at Algiers, while the 531st Engineer Shore Regiment and the 591st Engineer Boat Regiment provided shore parties for the Central Task Force, at Oran. The 36th Engineer Combat Regiment and the 540th Engineer Shore Regiment performed shore party duties for the Western Task Force, at Casablanca.

At Port Lyautey, 80 miles north of Casablanca, elements of the 15th Engineer Combat Battalion, 9th Infantry Division, helped seize an airfield adjacent to the port. This action began on November 8, when a raiding party that included engineers entered the mouth of the Sebou River to remove a navigation obstacle. Clearing this obstacle would allow the destroyer *Dallas* to move upriver and seize the airfield. The first attempt failed when gunfire from a nearby fort drove the raiders away, but the raiding party succeeded in removing the obstacle the next night. Early on November 10, the *Dallas*, with the raiders aboard, moved upriver and secured the airfield. The 888th Airborne Aviation Engineers then resurfaced the runway.

Besides the 888th Engineers, other engineer aviation units in the Western Task Force were the 887th Engineer Airborne Company and the 1st Battalion, 21st Engineer Aviation Regiment. The Central Task Force had the 809th, 815th, and 817th Engineer Aviation Battalions. These aviation engineers resurfaced damaged runways on airfields in the landing zones. Then they moved on to build airfields in Algeria to support future offensive operations in Tunisia.

Late that fall, the British First Army's Tunisian drive stalled in front of Tunis because of strong German opposition, bad weather, and supply problems. General Eisenhower, then commander of the Allied Forces Headquarters, halted the offensive on December 24. He decided to go on the defensive until spring, when the rainy season ended. He sent the U.S. II Corps to southern Tunisia to protect the First Army's exposed flank. Later they were to take the offensive against Rommel's line of communication, when the Germans withdrew from Libya.

The II Corps became operational at Tebessa, in southern Tunisia, on January 6, 1943. Its engineer strength consisted only of the 19th Engineer Combat Regiment and division engineers from the 1st and 34th Infantry Divisions and the 1st Armored Division.

Clearing mines in Kasserine Pass, February 1943.

Southern Tunisia

Allied intelligence, based on Ultra intercepts (intercepts of the German high command's code) predicted the Germans would attack the weak French forces in central Tunisia. Instead, their advance in the south, out of Faid Pass toward Sidi Bou Zid on February 14, inflicted heavy casualties on the U.S. 1st Armored Division.

On February 16, in conjunction with a general withdrawal caused by the German attack, the II Corps ordered the 19th Engineers to organize a defensive line at Kasserine Pass. In addition to his own regiment of 1,200 engineers, Colonel Anderson Moore headed a force of 2,000 soldiers made up of the 1st Battalion, 26th Infantry Regiment, 1st Infantry Division; three artillery battalions; and a tank destroyer battalion. Colonel Moore ordered his engineers to emplace mines and organized the artillery and tank destroyers. He positioned the 26th Infantry Battalion on high ground on the left, covering the road to Thala, and his engineers on high ground on the right, covering the road to Tebessa.

The 1st Armored Division withdrew through Kasserine Pass on the 17th, as the engineers prepared to stop any enemy effort to force the pass. German patrols and preparatory artillery increased in intensity through February 18th. Their probing attacks the next morning failed to penetrate the pass, but that afternoon a strong German effort forced Company D, 19th Engineers, out of its defensive position. A counterattack to restore their position failed, but by evening, although weakened, the line remained intact. Before dawn the next day, German soldiers forced the infantry on the left to withdraw, thus exposing the engineers' left flank. That afternoon the engineer line broke, and the Germans were through the pass.

In defending Kasserine Pass, the 19th Engineers' casualties were 11 killed, 28 wounded, and 88 missing. Their 3-day holding action, however, allowed time for reinforcements to take strong positions in hills beyond the pass. These forces stopped Rommel by February 22, and the Germans began to withdraw through Kasserine Pass to their original positions the next day.

As the Germans withdrew, the Allies took the offensive in southern Tunisia. The II Corps, with engineer reinforcements that included the 20th Engineer Combat Regiment and the 175th Engineer General Service Regiment, attacked south through Gafsa toward Maknassy on March 17.

Engineers repair an airfield in North Africa, January 1943.

The 1st and 19th Engineers removed mines and turned almost 100 miles of trail into dirt roads that the 1st Infantry and 1st Armored Divisions used in their advance.

Attacking toward Maknassy, the 1st Infantry Division had to break through a strong defensive position on high ground east of El Guettar. At dawn on March 21, after a night infiltration movement of about 10 miles, the 1st Ranger Battalion, supported by a 1st Engineers' mortar platoon, attacked the rear of the defensive position; the 26th Infantry, supported by Company C, 1st Engineers, attacked the front. The Germans began to withdraw by noon, and the way to Maknassy was open.

The German withdrawal into northern Tunisia squeezed the II Corps out of the line in the south. The II Corps then moved north, onto the left flank of the First Army, for the drive toward Bizerte and Tunis. The engineers found that the hilly terrain and lack of maneuver room made the German-blown bridges an effective deterrent to their advance. The 16th Armored Engineer Battalion's capability with the Bailey bridge, which they had trained with in England, helped to solve that problem.

Northern Tunsia

The final offensive, in northern Tunisia, began on April 24. The 20th Engineers supported the French Corps d'Afrique and the 9th Infantry Division on the left, while the 19th Engineers supported the 34th and 1st Infantry Divisions and the 1st Armored Division on the right. The engineers maintained almost 100 miles of macadam and 250 miles of dirt roads during this attack. With the advancing infantry units following the high ground, the engineers built almost 75 miles of new roads to connect the main supply routes with the pack mule trails in the hills.

During this last offensive, the 15th Engineer Battalion, 9th Infantry Division, successfully used its engineers in support rather than attachment, thus keeping engineer assets under centralized battalion control. A company supported each of the two attacking regiments, while a platoon supported the reserve regiment. Each company used three echelons to provide a small group of reconnaissance engineers for forward infantry elements. An engineer platoon maintained mountain trails, and the rest of the company helped the artillery displace forward. The remainder of the engineer battalion was under division control for use where needed most.

When the North African campaign ended on May 13, 1943, the engineers had gained more than 6 months of experience in 20th century mobile warfare. They had made some mistakes and taken some hard knocks, but they had learned a great deal.

In Operation Torch, the amphibian engineers learned the value of establishing a good working relationship between the Navy and the landing force. The aviation engineers learned the amount of effort required to maintain and construct airfields in a theater of operations. While the combat engineers had known they could be used in infantry missions, they now understood the need for realistic infantry training. German land mines were new to the engineers, but their ability to overcome these obstacles grew with each encounter. The Bailey bridge, new to American engineers, rapidly became their favorite device for spanning rivers and repairing roads. After the North African campaign, U.S. Army engineers moved to Sicily and Europe, where they applied what they had learned in North Africa.

* * *

Additional Reading:

Beck, Alfred M., *The Corps of Engineers: The War Against Germany*, U.S. Government Printing Office, 1988.

Howe, George F., *Northwest Africa: Seizing the Initiative in the West*, U.S. Government Printing Office, 1957.

Dr. James Dunn is chief, Studies and Analysis Division, Office of History, U.S. Army Corps of Engineers, Fort Belvoir, Virginia.

BRIDGE THE GAP

By Command Sergeant Major Roy L. Burns, Jr.
U.S. Army Engineer School

The times become more interesting as we continue our mandated drawdown.

> *"Training is the Army's top priority; it prepares us to fight. As leaders, our sacred responsibility is to ensure that no soldier ever dies in combat because that soldier was not properly trained."*
>
> *General Carl E. Vuono*

During my first three months as the Engineer Center Command Sergeant Major, I visited several units across the country to assess the quality of soldiers trained here at the Engineer Center and determine training needs. I visited the 13th and 14th Engineer Battalions, Fort Ord, California; the 11th Engineer Battalion (Combat), National Training Center, Fort Irwin, California; and the 24th Infantry Division's engineer brigade as well as the 92nd Engineer Battalion (Combat Heavy), Fort Stewart, Georgia. Throughout the tour, I spoke with all ranks, from division commanders to privates. My conversations with them were interesting, straightforward, and to the the point!

The strongest points I discussed with senior leaders were:

- We must continue to provide tough and realistic training to our soldiers.
- We must provide the proper equipment to units and soldiers in order to conduct training properly.
- We must continue to enforce the standards that will keep our soldiers safe in training areas and on the battlefield.

I learned that soldiers in skill levels 10 through 30 are most interested in the education and job opportunities expected in our future Army. Most of the soldiers I spoke with had tremendous confidence in their leaders. As engineers, however, they wondered where our responsibilities fit into the overall scheme of an ever-changing and currently downsizing Army. To answer that question, a review of our history is revealing: Engineers have always stood ready to complete their assigned missions, always executed and completed training preparations, and always executed their missions on the battlefield. We were taught to protect the force as leaders and as subordinates—and we must continue to do so in these uncertain times. There is tremendous anxiety among engineer troops about where our force is heading. The crystal ball is not clear about the future, but it is clear enough for us, as leaders, to show genuine concern for our soldiers!

A key area we must continue to emphasize is education. As leaders, we must ensure our subordinates develop themselves professionally through both the military and civilian education systems. Our training efforts must be flexible enough to positively develop and enrich subordinates. The young soldiers I spoke with want education to keep themselves competitive.

As our Army gets smaller, senior leaders must continue to assist in making soldiers smarter! They must push to give soldiers the additional training they need to grow within a smaller but quality Army. Someone, somewhere gave our senior soldiers that chance. We must continue that tradition during these changing times.

To help young soldiers develop themselves, we must assess their skills honestly and provide a means for development. One first sergeant I spoke with designed a program based on his soldiers' GT scores. Soldiers with GT scores below 100 could not attend college. Instead, they worked to raise their Armed Services Vocational Aptitude Battery (ASVAB) scores through the Basic Skills Education Program (BSEP). After their ASVAB scores were raised, the soldiers attended college! This creative program provided an opportunity for *success* based on what the senior leader considered an equitable system for everyone. It provided all soldiers a fair chance to successfully attain a college degree (or credit toward a degree) without mission degradation.

As senior leaders, we must continue to provide the guidance and tools required to make our soldiers successful in training areas, in school, and on the battlefield. They are our most precious resource and reflect our success as leaders and mentors!

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Bridge Building in Somalia

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CLEAR THE WAY

By Major General Daniel W. Christman
Commandant, U.S. Army Engineer School

Greetings once again from the Ozarks! Just finished another outstanding SELTC (Senior Engineer Leaders Training Conference) and I must say—never have I been more impressed with the professionalism, agility, and versatility of the Corps of Engineers! It is now crystal clear to all of our Army's senior leadership that engineers are an integral part of the combat combined arms team as well as vital contributors in the combat support and combat service support arenas. Our exceptional performances in recent operations other than war, including disaster relief, nation assistance, counterdrug operations, peacemaking, and peacekeeping operations, graphically demonstrate our capabilities and versatility. As always, we are committed in extremely diverse circumstances and geographic areas—but the results are outstanding for each and every mission. Super job—keep it up!

Now, some information about what is happening at your Engineer Center. Yes, we too are reorganizing. By the time you read this, the current Directorate of Training and Doctrine and Department of Instruction will be combined into a new Directorate of Training (DOT). The meshing of these two major assets will greatly enhance our ability to provide excellent training for students at the Engineer School. The consolidation will improve our ability to write doctrine because we will have a clearer and simpler chain of command that combines responsibilities for these important functions. Additionally, the reorganization will allow greater flexibility in responding to future training load changes and improve our ability to absorb minor structural changes. We will improve the linkage between trainers and training developers, and improve the expertise and utilization of instructor personnel. Last but not least, the structure of the Engineer Center brigade is being economized: the newly reorganized brigade will consist of an Officer Student Battalion, an Advanced Individual Training Battalion, a Staff and Faculty Battalion, and a Support Battalion.

These changes will unquestionably enhance our ability to produce a better product—better trained soldiers—in the near future. However, like our great friends the Marines, we are looking for a few good men and women to help implement these changes and help shape our Engineer Center and Corps for the 21st century. Unique opportunities abound for those of you who wish to be on the cutting edge of shaping our future here at Fort Leonard Wood. Your school has provided personnel and resources to virtually every major engineer deployment, including Desert Shield\Storm, the restoration of Kuwait, hurricane clean-up operations, Somalia, Bosnia, drug\counterdrug operations with Joint Task Force 6, and nation assistance with Joint Task Force Bravo. We will continue to provide these kinds of support to both our Army and our sister services. Nowhere else will you be exposed to such a vast array of unique engineer operations or have the opportunity to help shape the future of our branch and the Army. Contact your branch manager if you are interested in an assignment here at the Engineer Center. Would love to have you as a member of our team. Hoo-ah!

Had a unique opportunity to speak with the French Engineer Corps recently, as part of the Vauban-Putnam lecture series. French engineers, too, are concerned about the new world order and what impacts it will have as they restructure and downsize their force. Much like us, the French are trying to balance the realities of available resources with the needs of their country to maintain a robust and capable armed force. Although it was comforting to realize that we are not alone in struggling with this issue, the most refreshing part of that exchange was reflecting on the close relationship between our two branches. As most of you know, our Corps of Engineers has been closely aligned with French engineers since the American Revolution. We owe much to them for our initial structure and professional development. Our motto, ESSAYONS, is a tribute to the French engineers who helped shape our corps' character more than two centuries ago. For this, and for our continued cooperative alliance, we must remember the French engineers' contributions to our Engineer Regiment.

All the best from the heart of the Ozarks! Keep up the great work!

Engineer

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Cover photo: *Engineers from the 41st Engineer Battalion (Light) construct a Bailey bridge over the Juba River in Somalia.*

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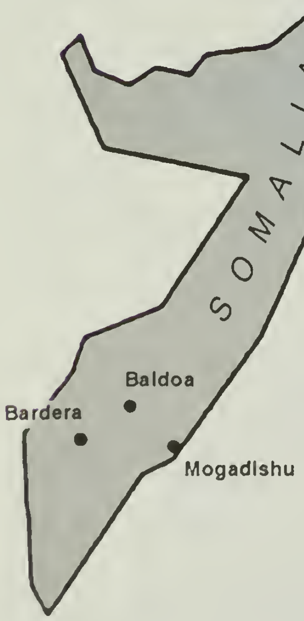
36th Engineer Group in Somalia:

Operation Restore Hope



By Officers of the 36th Engineer Group

Since the fall of the Marxist government in February 1991, Somalia has been torn by civil war. The territory of the former nation was divided among several warlords, who locally filled the void left when the national government ceased to exist. Civil strife, coupled with drought and crop failures, led to severe food shortages and displaced large segments of the population. Beginning in August 1992, the United States participated in UN-sponsored humanitarian relief efforts, primarily flying food shipments to remote areas. From the beginning, banditry and organized resistance from rival clans hampered these efforts. In November 1992, the Bush administration decided that the situation demanded a new approach—a U.S.-led peacemaking mission to pacify the country.

Peacemaking is a relatively new concept in American foreign policy that goes beyond the traditional UN peacekeeping role. In peacekeeping operations, diplomats establish an agreed peace; then the UN provides relatively light forces to monitor the arrangement. Peacemaking, by contrast, involves imposing

Elevated strongback tents in a Bardera base camp.

order on the warring parties as a prelude to diplomatic efforts in achieving a long-term political solution.

From a military standpoint, peacemaking is similar to warfighting. Operation Restore Hope had all the characteristics of a major invasion, with the added challenge of simultaneously supporting humanitarian relief operations. The combat force was built around the 1st Marine Division and the Army's 10th Mountain Division (Light Infantry). Air Force and logistical support packages were tailored to deploy and sustain the joint task force (JTF).

Assembly of a theater engineer element to support the operation was crucial to the support package. Engineer missions included constructing and maintaining more than 2,000 kilometers (km) of main supply routes (MSRs), establishing life-support facilities (base camps) for U.S. and coalition forces, opening and maintaining airfields, and providing other special engineer support such as well drilling, port construction, mapping, and power generation. The two major components of this package were the Naval Construction Regiment (NCR 30), under the Marine Forces (MARFOR), and the 36th Engineer Group, with the Army Forces (ARFOR). This article addresses the ARFOR engineer support in theater.

Task Organization

Because significant engineer forces at nondivisional echelons were required to support the ARFOR, Forces Command selected the 36th Engineer Group as the engineer command and control headquarters. The troop list included the 43rd Engineer Battalion and the 63rd and 642nd Combat Support Equipment (CSE) companies. Those troops joined the 10th Mountain Division's 41st Engineer Battalion (LT) in providing the necessary engineer support for the ARFOR in theater.

The theater was divided into nine humanitarian relief sectors (HRSs) for the command and control of peacemaking coalition forces. For engineer support, Somalia was split into two work sectors. The northern sector was given to the Marine and Navy engineers, under the command of NCR 30. The southern half was designated as the Army engineer sector, under the command of the 36th Group. Supported maneuver forces in the southern sector included a brigade from the French Marines, an Australian Regiment, a U.S. Marine and a Belgian parachute battalion, and a brigade from the 10th Mountain Division.

Threat

The threat to engineer forces varied by geographic area

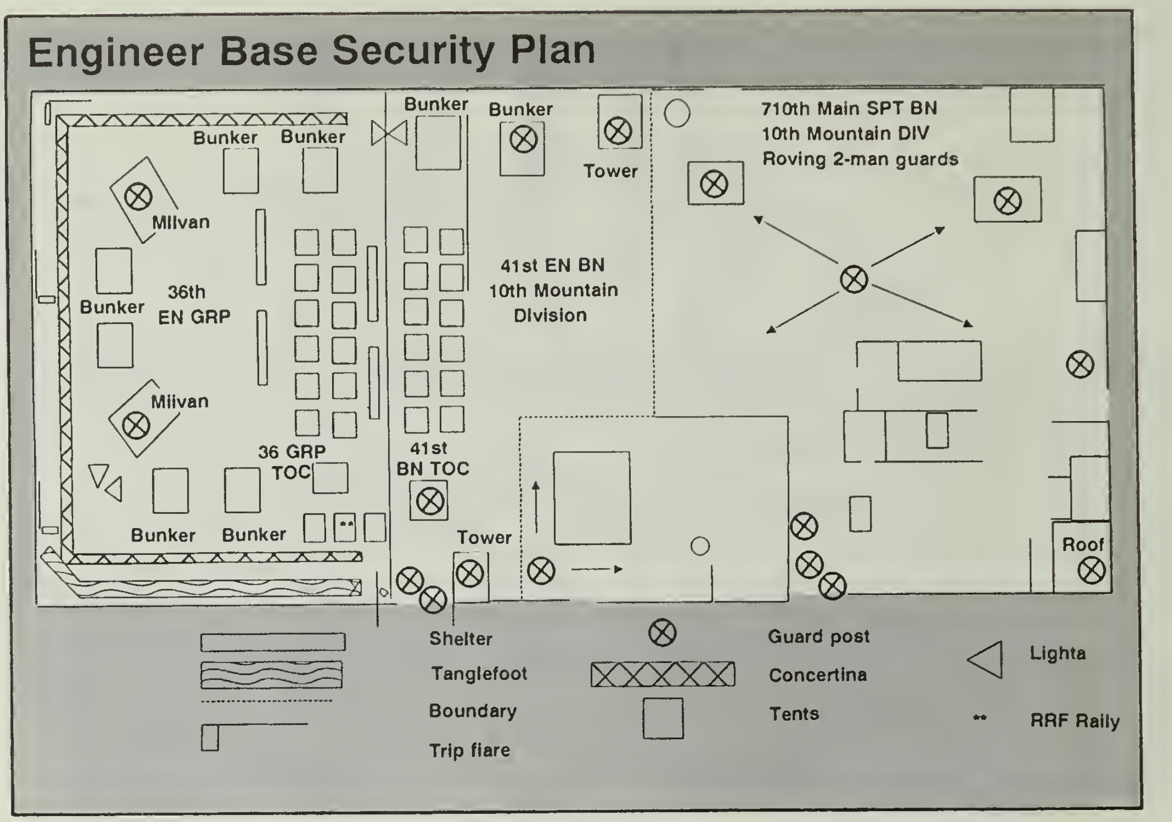


Figure 1

and included random violence, organized sniping, ambushes, criminal activity, and localized civil unrest. Criminal activity, the primary threat, included petty theft and rock throwing. Engineer Class IV items were a prime target for thieves.

Base defense and job-site security were major concerns. The base cluster in Mogadishu, as portrayed in Figure 1, included the 36th Engineer Group headquarters; HHC, 41st Engineers; and the 10th Mountain's 710th Main Support Battalion. The 36th used floodlights, trip flares, triple-standard concertina fences, and guard towers extensively. The base cluster security force ranged from 10 personnel during the day to 20 at night. Off-duty security personnel comprised the base cluster's quick reaction force (QRF). Shelters (bunkers) were built for personnel not on security or part of the QRF. The HRS commanders provided job-site security and the QRF to defeat levels two and three threats. Level two response was usually military police, while response to a level three threat was a tactical combat force. Depending on the HRS, that force included light infantry, armor, or attack helicopters.

Mission

The mission for theater engineers was to construct roads, airfields, and base camps to meet the end state conditions for transition to a follow-on UN command. The 36th Group staff developed a plan to complete the assigned missions in the ARFOR engineer sector by February 28, 1993. (See article, p. 8.)

Execution

In developing the road network for MSRs, towns were identified where food distribution was critical to keep thousands of Somalis from starving. The MSR upgrade mission included more than 1,000 kilometers (km) of roads linking critical towns, construction of 150 km of new roads through virgin terrain, maintenance of two airfields, and mine clearing operations.

Vertical construction focused on providing better living conditions for coalition security forces. Engineer forces conducted site surveys throughout the sector, while supported commanders of the coalition forces determined their base camp requirements. The vertical effort included construction of 300 latrines and showers, 110 tent floors, 55 wooden tent frames, 13 Southeast Asia (SEA) huts, and 75,000 square feet of roofing on existing buildings.

The ARFOR engineers also completed 35 civic action projects for many towns and nongovernmental organizations (NGOs),

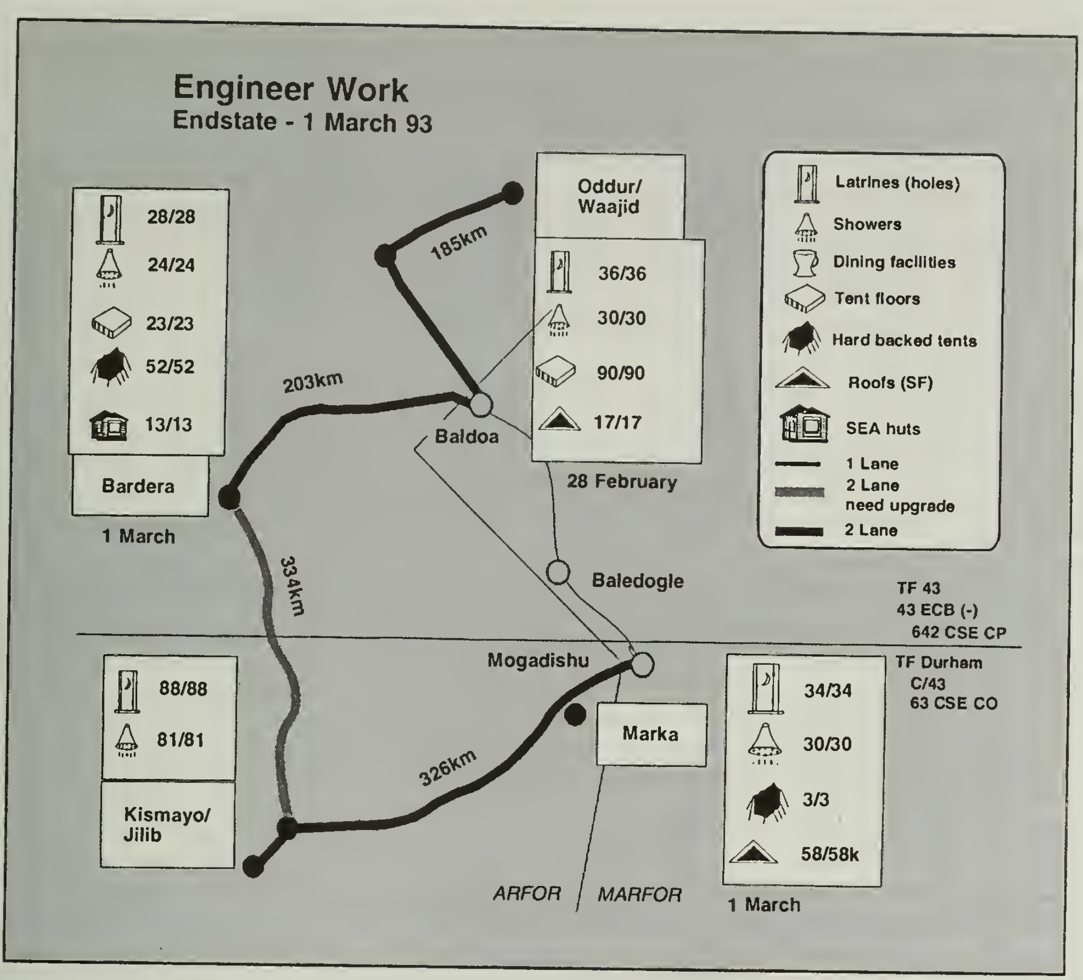


Figure 2

including school construction and renovations, well upgrades, land clearing, and building renovations. Civic action projects were important to support initiatives by local leaders and humanitarian-relief NGOs. Financial and legal constraints limited the construction support U.S. engineer forces could provide. The key criteria for evaluating civic action projects were that they must—

- Support relief organization initiatives.
- Benefit the community as a whole.
- Promote self-help in the area.
- Require little or no materiel investment.
- Not interfere with mission accomplishment.

To facilitate mission accomplishment, the 36th Group split the ARFOR engineer sector in half and task-organized for two battalion-sized task forces. In the north, TF 43 consisted of Headquarters and Support Company, A and B Companies of the 43rd, and the 642nd. In the south, TF Durham, commanded by the group executive officer, included elements from HHC, 36th Group; C Company, 43rd; and the 63rd. The two task forces developed individual plans for accomplishing their engineer missions. Progress was tracked graphically and portrayed work accomplished and remaining (Figure 2). This provided the ARFOR commanding general and his staff with a single document to track the engineers' progress.

Service Support

Somalia was an immature theater where austerity was the rule. The 36th took a conservative approach for planning purposes, with the goal of sustaining itself for at least 15 days in all classes of supply except Class III (bulk). Bulk POL was so scarce that they were allowed to ship full tank and pump units, but this provided only two days of supply (DOS). Based on guidance from the JTF engineer, the 36th deployed with 30 DOS of Class III, Class VI, select Class IX items, and enough materials to build two AFCS 1,000-man base camps. Each company had one 400-gallon water trailer with processed water for personal hygiene from the reverse osmosis water purification unit. Throughout the deployment, bottled water was procured for drinking and cooking requirements.

To visualize the needed extras, the S-4 section thought through a typical day in Somalia. This approach helped anticipate necessities such as "Australian" showers, laundry pails, clothespins, and sundries packs. In addition, the Fort Benning central issue facility provided a special CTA-50 issue, (including desert camouflage uniforms, mosquito nets and poles, 2-quart canteens, goggles, and sunglasses), plus plenty of Deet and Permethrin for insect control. These supplies, plus sets, kits, and outfits, filled 270 containers. Each container was marked with equilateral triangles on all sides to facilitate rapid identification and follow-on movement from port facilities. Accurate inventories were critical because containers were ultimately transported on three ships. With no reception facilities in country, passenger airflow was keyed to the ships' docking dates. This ensured that soldiers flying in to theater would not exceed the capacity of the life-support supplies and equipment on the ground. Once in theater, the advanced echelon (ADVON) S-4 section immediately began to prepare for the three logistical phases of the operation: reception, onward movement, and sustainment.

Reception

The morning after the ADVON's arrival, they began to ready the engineer base in Mogadishu for arrival of the main body. Battalion and company staging areas were laid out to link the soldiers with their equipment, establish accountability, and perform maintenance. While these linkups were taking place and soldiers were acclimating to their new environment the S-4 briefed supporting units on the mission and the support required to accomplish it. These meetings laid the groundwork for onward movement and sustainment.

Onward Movement

Forward area deployment was necessary before units could begin work. Logistical challenges included geographic distances, lack of infrastructure, and theater immaturity. Therefore, logistical base locations largely influenced forward base locations. The 36th found transportation to be difficult, with stiff competition for limited assets and frequent tire losses from traveling on unimproved roads.

Sustainment

Sustaining the force during mission execution would not have been possible without the superb support of the 593rd Area Support Group (ASG). Multiclass resupply logistical packages met the sustainment needs for seven companies spread over 1,100 km of road, with rations, one to three DOS of potable water, and one to two DOS of bulk fuel carrying capacities. Units within 50 miles of a logistical base provided their own vehicles to shuttle supplies. Outside that radius, the 593rd hauled three DOS, leaving required tankers and bladders with the companies.

To assist the 593rd in its initial planning, the S-4 developed a graphic portrayal of consumption rates. The number of soldiers at each location drove the ration and potable water consumption quantities (10 gallons per soldier per day). The ASG was notified daily of specific support requirements through a simplified logistical status report that permitted units to submit reports via tactical satellite (TACSAT). The system worked well, and all engineer missions were completed on schedule with no supply delays.

Maintenance

36th Group equipment maintainers knew the challenges that lay ahead because they had recently tested their equipment while participating in Hurricane Andrew relief efforts. Long logistical lines and the harsh environment required a beefed-up prescribed load listing (PLL) and authorized stockage list. Before deployment, the 36th purchased major assemblies, numerous tires, and commercial construction equipment repair parts and loaded them into containers bound for Somalia.

The engineer mission was well underway before the ASG became fully operational; therefore, repair parts had to last. The 36th sent two soldiers to Mombasa, Kenya, to purchase repair parts from a local Caterpillar dealer. The plan called for parts to be identified, purchased, and shipped to the requesting unit within 72 hours after equipment was determined not mission capable. Unfortunately, the 36th's demands were too large for the dealer's supplies, and the 72-hour criteria was seldom met. Still, procurement from Kenya saved valuable time when compared with the time required to ship parts from the U.S.

The long distances over which the 36th operated, coupled with the high operational tempo and the late arrival of several unit PLL containers, caused additional maintenance challenges. The 43rd established a direct-support (DS) engineer maintenance base in Baidoa, where they worked with an Australian contingent to replace major assemblies. Along with their organic DS, the 43rd had a

Engineer Tasks

Residual Engineer Force METL	*Priority of Responsiblity*		
	Somali Labor	Coalition Forces	Engineer Force
Force Protection	2	1	3
Countermine Operations	- - -	1	2
Maintain Airfields to C-130 Standards	3	2	1
Maintain All-Weather MSRs	1	- - -	2
Other Major MSR Maintenance (Dry Season)	- - -	- - -	1
Maintain Base Camps Beyond Self Help	- - -	- - -	1

five-man team from the 598th Maintenance Company. This team provided valuable DS automotive service to engineer units in theater. The 63rd and their DS engineer maintenance team, along with a DS automotive maintenance support team from the ASG's 602nd Maintenance Company, were deployed to Jilib to support TF Durham.

Communications

Operation Restore Hope was complicated by extensive distances and austere communications packages. The 36th's organic FM vehicle communications needs were met by installing a new single-channel, ground-to-air radio subsystem (SINCGARS) just before deployment. The SINCGARS radios operated well in the hot, arid, dusty environment. After nearly two months, the only SINCGARS radio to experience operational failure was found to have been installed incorrectly.

While SINCGARS provided basic FM communications for short distances, additional systems were required to connect widely dispersed construction teams. This support came from a combination of single-channel TACSAT radios, older high- frequency radios (AN\GRC-106), SINCGARS FM retransmission stations, and telephone communications provided by mobile subscriber equipment. All units in sector had redundant communications capability. By using a network of old and new technologies, the 36th retained command and control of the engineer force throughout the operation.

Health and Safety

No serious injuries or deaths occurred within the 36th during the two-month operation. Units obtained excellent intelligence information before deployment regarding safety and health risks soldiers would face in this hazardous environment.

Preventive medicine classes were incorporated into readiness processing. Soldiers received instruction on health hazards and preventive measures necessary to minimize them. Chain-teaching classes were given on rules of engagement and medical evacuation procedures, and all soldiers received situation training. Standards on safety, proper wear of the uniform, and preventive medicine were printed and distributed to soldiers in a pocket-sized format. Unit success was attributed to minimizing risks through intelligence and assessment, providing training, and enforcing standards.

Residual Engineer Force

Engineer staffs at the JTF, ARFOR, and 36th Group worked together to develop the residual engineer force's (REF's) mission statement to maintain minimum acceptable MSRs, airfields, and base camps until United Nations Operation Somalia, Phase II was established. Analysis of work requirements identified six major tasks (see table, page 7), which were matrixed against who had primary, secondary, and tertiary responsibility for each. Primary responsibility for half the tasks lay with local labor or coalition forces, not with the REF.

Based on this analysis, engineer force requirements included one vertical platoon to accomplish force protection and base camp repair tasks, and two horizontal platoons to complete countermine operations, airfield maintenance, and all-weather and dry-season MSR maintenance. This force could be best provided by a CSE Company augmented with a combat heavy vertical platoon. The 63rd and a platoon from B Company, 43rd, remained in theater as the residual engineer force. The 63rd was attached to the JTF Support Command to maintain the infrastructure necessary for continued logistical support to the coalition forces in theater.

Conclusion

Operation Restore Hope, a historic undertaking for the U.S. armed forces, may be typical of the military's mission in the post cold-war era. The deployment was a unique opportunity for the soldiers of the 36th Engineer Group, joint, and combined forces to make a difference in a country desperate for assistance. By constructing roads, base camps, and airfields in Somalia, engineer units continued a legacy of providing assistance to nations throughout the world.

Coauthors include COL Phillip R. Anderson, LTC Dwight S. Durham, MAJ Chris Buswell, MAJ Earnest Brown, MAJ Mario Carrillo, MAJ Mark Feierstein, MAJ Michael Meeks, and MAJ Albert Bleakley.

Determining the Engineer End State

By Colonel Robert Flowers

"It is hard to get there if you don't know where you are going."
A Wise Man

One of the most difficult tasks facing a tactical commander deployed in a contingency operation is to envision the end state his force must achieve in order to accomplish the mission. In combat operations such as Operation Desert Storm, the destruction of the enemy's force or controlling specified terrain may be key indicators of success and victory. In operations with less clear objectives, such as Operation Restore Hope in Somalia, gaining a clear vision of the objective end state is significantly more difficult. This article describes the process the Joint Task Force (JTF) used to define the engineer end state for coalition forces and to assist the commander in developing his operational end state.

The austerity of the theater's infrastructure drove the operations tempo for JTF Somalia. The country lacked nearly everything. There was no civil government. Basic utilities such as water and electricity were nonexistent. Seaports, roads, and airfields were severely limited in capability and were in serious disrepair. Buildings of all kinds were rubbled, bullet-ridden, vandalized, and in most cases had no roofs. Such problems meant the engineer mission would be extensive. Further, the mission would be oriented to providing mobility and sustainment engineering operations in support of the JTF's employment in country, self-sustainment, and humanitarian relief efforts.

For engineers, an end state had to be defined in terms of the amount of work to be done and the construction standards to be met. To gain a vision of the engineer end state, the JTF engineer staff coordinated fully with other JTF staff sections and developed several options for theater engineer operations. The J2 staff and the engineers jointly analyzed intelligence on the condition of the infrastructure and the security situation. They obtained the commander's intent and the concept of the operation from the J3, both verbally and through the basic operations order. The J4 provided planned main supply routes. Available resources such as engineer soldiers, construction materials, and civilian contract construction support were also carefully considered.

End State Options
(Construction Standards)

Option	Facilities	Date	Mission Supply Routes
1	Tents with wooden floors Field latrines	1 Feb	Emergency repairs only Passable - one way
2	Strongback admin tents Showers Austere kitchens	15 Feb	Two-way traffic
3	All strongback tents Mess facilities Maintenance area	7 Mar	Subbase stabilization Some drainage
4	SEA hut admin areas Laundry facilities Water wells Maintenance hardstands Food storage (tents)	1 Apr	Grading, shaping Drainage
5	All SEA huts K-Span food storage	15 May	All-weather, Class 30 at 35 mph

Various assumptions were made to fill the void where facts were not available. The first assumption was that all seaport engineer construction or repair operations would be executed by a civilian contractor. The second was that, at a minimum, a C130-capable airfield would be required at the hub of each of eight humanitarian support sectors. They would provide initial support and, later, contingency support to coalition force sustainment and humanitarian relief operations. The third assumption was that some slippage of engineer units arriving in theater would occur due to competing priorities for the limited airports and seaports. The fourth assumption (but definitely not of least importance) was that sufficient construction materials would be available to accomplish the mission.

Based on thorough staff coordination and determination of the facts and assumptions, the JTF engineer staff developed details for each option. These details focused on the amount of work to be done, the construction standards to be met, the engineer units required to do the work, and the time it would take to execute each option. Before briefing the JTF commander for a decision, the engineer staff briefed the commander of each subordinate component (U.S. Army, Air Force, Marine, and coalition partners) to gain feedback and concurrence. This coordination was instrumental in gaining a decision from the JTF commander because the components were now organic to and had a vested interest in developing the plan.

Having the components' feedback and concurrence, the JTF commander was briefed on the five options (see chart). He selected option 2 with minor modifications and published a fragmentary order directing its implementation. The components, already directly involved in the plan and now having an end state to reach, set to executing the plan. Minor variations occurred because the arrival dates of some engineer units and construction materials slipped, but the mission was accomplished successfully.

Commanders of contingency forces will often need help creating a vision of their end state. Engineer commanders and staff officers have the obligation, not to mention the interest, to ensure that senior commanders understand the engineer implications associated with the mission. Engineers must be proactive in showcasing potential engineer end states to help their commanders focus on the operational end state.

Colonel Flowers is the Director of Training at the Engineer School. He served as the Joint Task Force Engineer in Somalia from 5 Dec 1992 to 28 Feb 1993. Previously he served as commander of the 20th Engineer Brigade (Combat Airborne Corps), and led that brigade as an expanded force of 10 battalions during Operations Desert Shield/Storm. Colonel Flowers has a master's degree in civil engineering from the University of Virginia and is a graduate of the National War College. He is a registered Professional Engineer in Virginia.

Bridging the Juba

By Captain Joey Wyte

Before deploying to Somalia, sappers from Alpha Company, 41st Engineer Battalion, characterized mobility operations as bangalore breaches, pop and drops, and hasty mine sweeps. Early intelligence reports indicated that large quantities of mines had been randomly placed throughout Somalia over the past two years. Based on this information, battle drill rehearsals centered around mine sweeping and clearing operations. In Somalia, however, the sappers found that while mobility was their primary mission, physical engineer reconnaissance changed their way of thinking.

Bravo Company, 41st Engineer Battalion, had deployed with the 10th Mountain Division's 2nd Brigade in late December 1992. Their reconnaissance teams reported that a major washout at the Juba River north of Kismayo had closed the inland main supply route (MSR). Alpha Company's advance party arrived in Somalia on January 7, and the main body closed on Mogadishu two days later. On January 10, they received the mission to emplace a Bailey bridge to open the MSR. Reality had hit.

To accomplish the mission, the company relocated to the port city of Kismayo, 250 miles south. They received additional equipment from the 43rd Engineer Battalion and Bravo Company, 1st Platoon. Equipment now consisted of seven HUMMWV's, two 5-ton trucks, three stake and platform (S&P) rigs, two 20-ton lowboys, one D8 dozer,

A crane is used to emplace bridge panels.

The bridge opening provided a means to move northward, and thus supported troop efforts for humanitarian relief operations in the Juba Valley.

one 25-ton crane, a contact truck, and a wrecker. So much for being light!

The first task was to organize the company and attachments for the move. The washout prohibited ground movement, and air transportation was not viable for the heavy equipment. Therefore, the company decided to make maximum use of LCU-2000 craft from the Army's 710 Boat Company to conduct an intratheater sea movement. Personnel and selected pieces of equipment flew by C-130 aircraft on January 12 and 15. The remaining equipment was loaded on two LCUs and arrived at Kismayo on January 16.

Getting the Bailey bridge into Somalia was no easy task. Two bridge sets from England and two erection sets from Germany were identified for shipment. Because the situation was urgent, these parts were flown to Somalia on four C-5A and two C-141 aircraft. The battalion staff worked diligently at matching equipment with aircraft and coordinating with other staffs to make movement a reality. These actions finally came together on January 20 and 21, when the bridge parts arrived in Kismayo.

While waiting for the bridge to arrive, Alpha Company conducted leader's reconnaissance and rehearsals and finalized plans for bridge erection. The initial design called for a 160-foot, double-truss, triple-story bridge capable of Class 55 traffic. Modifications to this design made use of an intermediate pier and called for a triple-truss, triple-story bridge capable of Class 80 traffic. Other planning determined that 15 S&P loads over two days would be required to haul the bridge parts 45 kilometers from Kismayo's airfield to the bridge site.

Site preparation was another task. Upon arrival, the company discovered that local businessmen had established a market at the washout site, including ferry service across the gap. Construction was delayed while the company relocated the market downstream with the aid of psychological operations, civil affairs, and interpreters.

After all parts were in place, Alpha Company began construction on the largest Bailey bridge built by U.S Army engineers outside of CONUS since the Vietnam War. Survey teams from the 43rd Engineer Battalion assisted in site layout. Two senior bridge NCOs from the Engineer Center at Fort Leonard Wood were flown in to provide technical expertise. Synchronization of panel, transom, and pinning crews was textbook perfect. The 25-ton crane and D8 dozer proved invaluable. By the end of the first day of construction, 13 of the required 16-panel sections were erected.

The bridge was completed by close of business on January 24. Clamps, stringers, and bolts were welded to prevent removal. PSP matting was placed on the decking to increase the wear surface and prevent theft of the wooden chess.

Although the soldiers did not anticipate emplacing a Bailey bridge, it proved to be an exciting and rewarding mission. The bridge over the Juba was a critical part of restoring Somalia's infrastructure. It allowed for inland movement of relief supplies to an impoverished population. The mission redefined mobility operations for light engineers and brought new meaning to the battalion's motto, "Sappers Forward!"

Captain Joey Wyte is commander of A Company, 41st Engineer Battalion. Previous assignments include assistant operations officer for G-3, 10th Mountain Division, and platoon leader, company executive officer, and S-1 for the 9th Engineer Battalion. He is a graduate of the Engineer Officer Advance Course and earned a bachelor of science degree at Western Carolina University.

Engineer Support to Peacekeeping

By Major Boyd D. Houck

"If you think peacekeeping is expensive, try war."

> *Attributed to COL David J. Lofgren, former Chief of Logistics for the Multinational Force and Observers in Egypt*

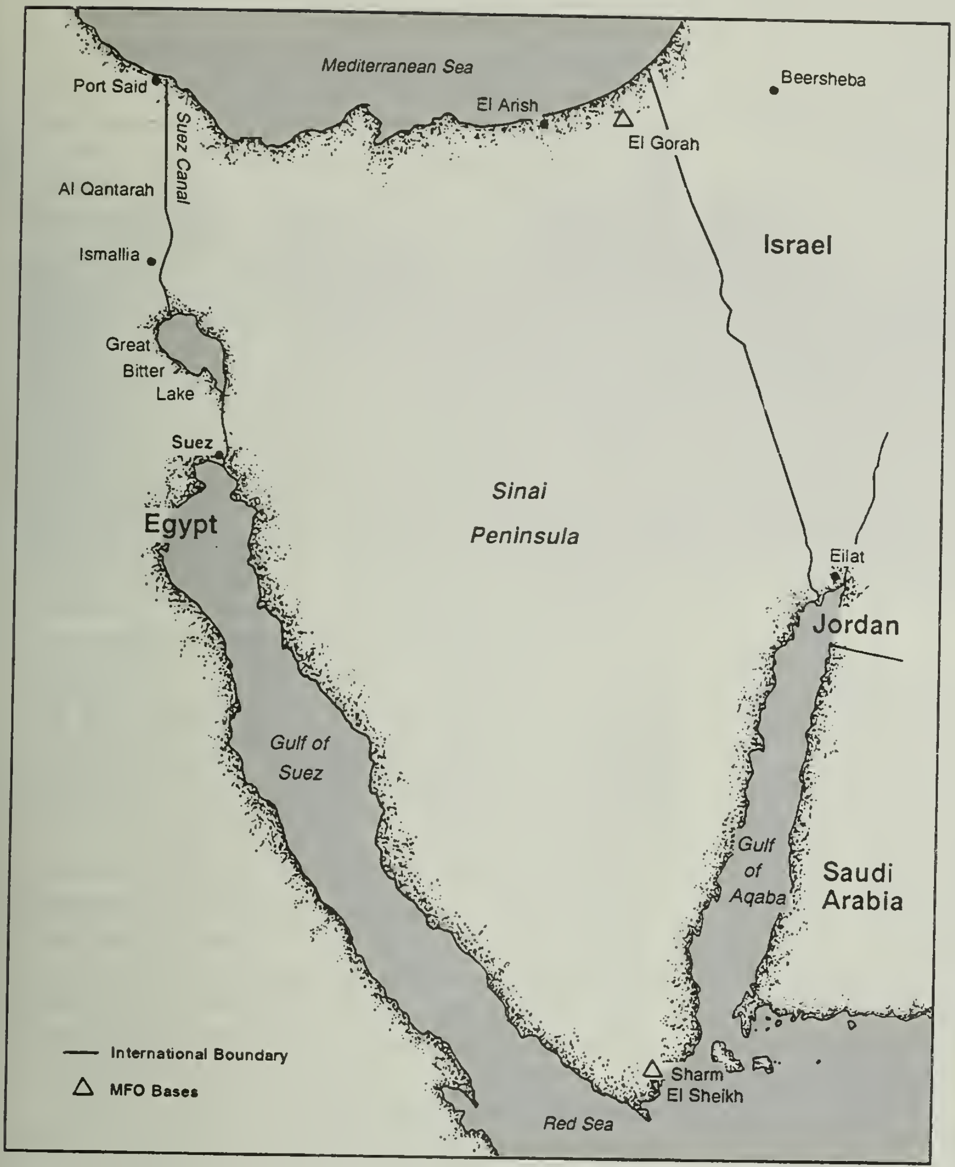
In recent years, peacekeeping operations have gained greater visibility and importance because they contribute to local and regional stability. As bipolarity faded, many local rivalries that had been contained by the influence of world superpowers burst into open conflict. The world community realizes the value of containing these conflicts so they can be resolved (or at least defused) peacefully. As a result, there is an increasing call for peacekeeping operations to stabilize hot spots in Europe, Africa, and Asia. This article addresses planning considerations for engineer support to peacekeeping operations and highlights basic issues engineers should address when preparing to deploy as part of a peacekeeping force. Experiences from the Multinational Force and Observers (MFO), a peacekeeping organization along Egypt's border with Israel, provide real-life examples throughout the article.

Overview

Peacekeeping is a primarily military operation designed to achieve the political goal of maintaining peace between two or more parties to a conflict. Such operations help maintain the negotiated settlement of disputes. In general, all belligerents must want peace for such an operation to be successful. Peace, however, is not the same as the absence of conflict or disagreement—it is the remnants of hostility and the root causes of conflict that necessitate the presence of a peacekeeping force. The residual animosity between the conflicting parties has a major impact on the nature of the peacekeeping environment.

View of the main gate to the MFO's North Camp. Gate guards are soldiers from a Colombian infantry battalion.

Engineer support to peacekeeping operations covers a wide range of activities, from constructing or maintaining facilities to marking or clearing minefields. Peacekeeping may include any of the basic engineer missions of mobility, countermobility, survivability, sustainment engineering, and topographic engineering. Individual engineers may hold staff positions within peacekeeping organizations or function as observers. Specific requirements for types and numbers of engineer units and for specialized engineer equipment depend on the nature, duration, and



size of the operation, as well as the operational environment. Army Field Manual 5-114, *Engineer Operations Short of War*, chapter 6, describes planning for peacekeeping operations. Throughout this article, I will address one situation where the U.S. Army is providing engineer support to an international peacekeeping operation.

The Multinational Force and Observers

The MFO is an international organization that helps keep the peace in the Middle East. An Egyptian-Israeli protocol (signed August 3, 1981) established the MFO to observe, report, and verify compliance with the Egyptian-Israeli peace treaty of March 26, 1979 (the Camp David Accords). The MFO consists of both a military force (the "Multinational Force") and a civilian observer unit, or COU (the "observers"). It is not affiliated with the United Nations (UN) but was set up after the UN was unable (due to the international political climate at the time) to establish a peacekeeping force in the area.

Two camps serve as the MFO's primary bases of operation in Egypt's Sinai Peninsula. One camp is located in the north near the town of El Arish, and the other is in the south near the resort town of Sharm El Sheikh. In addition, approximately 30 remote sites along the eastern edge of the peninsula support the MFO's mission. Eleven nations are currently represented in the MFO.

Engineering Support to the MFO

A U.S. Army engineer lieutenant colonel and two U.S. Army engineer majors currently serve 1-year tours with the MFO. The lieutenant colonel serves as force engineering officer and is the force commander's staff engineer. One major serves as the deputy force engineering officer, while the other is the facility engineer for the South Camp. An Australian engineer major oversees engineering support at the North Camp. The remote sites are the responsibility of an engineer major from New Zealand. Each of these officers has a noncommissioned officer to assist with daily operations. Military and civilian personnel from Canada, Fiji, and Egypt round out the engineering staff with design, administrative, and technical expertise.

Engineer support for the MFO is predominantly provided by Egyptian contractors and a U.S.-based support contractor, Holmes and Narver Services, Inc. In addition, the government of Uruguay has contributed an engineer detachment that furnishes heavy engineer equipment support and maintains roads that provide access to and between the remote sites. The major units that participate in the peacekeeping operation (infantry battalions from the U.S., Colombia, and Fiji) also have engineers assigned or attached. The variety of sources providing engineer support and the multinational nature of the supervisory structure create unique opportunities and challenges for engineers participating in the MFO's operation.

General Considerations

Political nature of peacekeeping. Anyone who participates in a peacekeeping operation must keep in mind its political nature and objectives. Peacekeeping is one of the most clearly political uses of military forces to achieve a political aim. The political nature of these operations may result in requirements, restrictions, and limitations (such as on the use of force) not normally experienced in other types of operations. To the soldier on the ground, these imposed conditions may not seem logical. For the statesmen involved in gaining acceptance of a peacekeeping force, they may be essential prerequisites for gaining the belligerents' acceptance of foreign troops on their soil. Thus, peacekeepers must be fully briefed on all aspects of the operation.

The governments of Egypt and Israel appoint a civilian as the director general (DG) of the MFO. The Force Engineering Office in the Sinai coordinates with the DG's staff in Rome on all engineering-related matters. As the offices interact to address issues, develop programs, and resolve problems, they consider the political implications of potential courses of action. After spending time in the MFO and gaining a better understanding of its purpose, one begins to appreciate the importance of reviewing the political impacts of decisions. A peacekeeping organization is clearly an extension of political will—peacekeepers deploy to an area to fulfill a political mandate. While we in the U.S. military understand the concept of civilian control of the military, we usually do not deal with it on a daily basis. When one works in an organization such as the MFO, where civilian leadership is not that far removed in the chain of command from those who actually keep the peace, the linkage to political leadership becomes very clear.

Multinational aspects. Most future peacekeeping operations in which the U.S. will participate will be multinational. This has two principal effects. First, sharing the costs lessens the burden on any one nation. Second, multinational participation adds legitimacy to peacekeeping operations and makes them less open to charges of being the imposition of one nation's will. Unique requirements may arise in multinational operations when soldiers of each participating nation interact with other soldiers whose cultures may seem totally alien. Open-mindedness is essential to maintaining harmony within a multinational force. Individuals at all levels must keep personal preconceptions from interfering with force functions. Because language differences may be a barrier to smooth operations, peacekeepers should learn some key phrases in the languages of other nations participating in the operation.

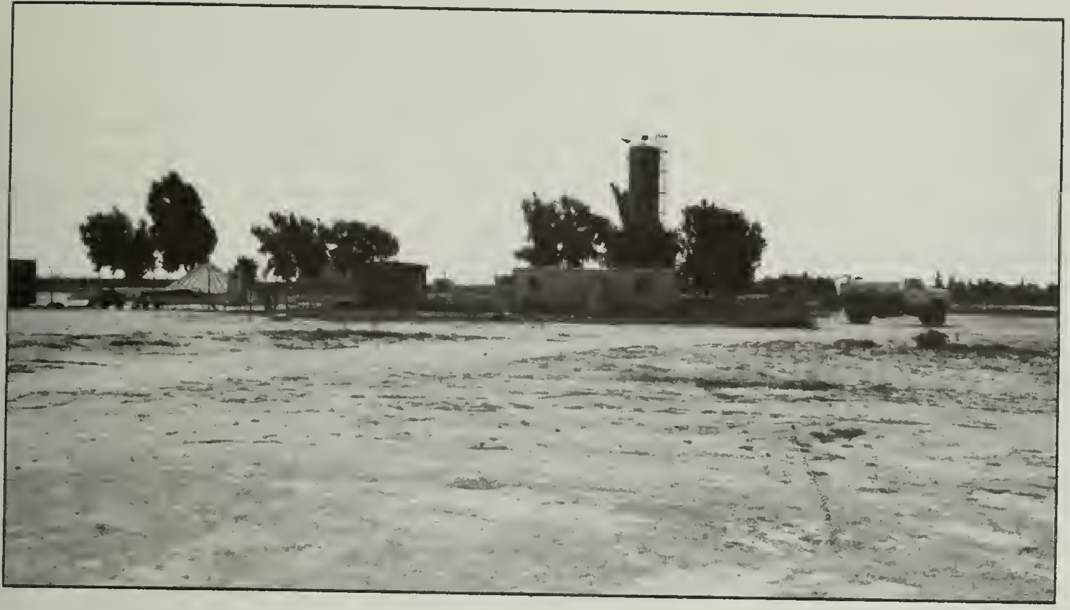
We in the U.S. often think of language barriers as existing only between English- and non-English-speaking peoples. However, communicating with others who speak English (those who feel they speak real *English!) can also be a challenge. While many terms are the same on both sides of the Atlantic and the Pacific, some words have additional meanings that differ from those with which we are familiar. Many basic engineering terms (such as beam, slab, and joist) seem to be universal but some are unique to Commonwealth countries (the United Kingdom, Australia, New Zealand, etc.). For example, "metal" may mean gravel, "plant" refers to equipment, and "gullies" are drains. It takes a while to learn basic Commonwealth engineering terms, but it is an interesting process.*

Interaction with the local populace. In addition to maintaining peace in an area, peacekeepers are informal ambassadors of their countries. Members of a peacekeeping force normally wear a distinctive uniform, and the force becomes a very visible entity in a sensitive and potentially explosive situation. Peacekeepers should attempt to understand the culture and language of the people they are assisting.

The relationship between the local populace and a peacekeeping force must be kept in balance. Peacekeepers must remain impartial and not appear to take sides in a dispute because a perceived bias can destroy their effectiveness. On the other hand, peacekeepers cannot appear aloof or uncaring. They operate in a region at the invitation of the parties to a conflict and must look upon the local populace as their *partners* in maintaining peace. Maintaining this balance is essential for successful peacekeeping operations.

Temporary nature. A peacekeeping operation ideally is a short-term activity. Upon the final resolution of a conflict, a multinational force can be disbanded, withdrawn, and returned to the contributing countries. Few nations can afford to devote a significant portion of their military forces for protracted periods to providing peace and security for others. While some peacekeeping operations have lasted for extended periods, most are temporary endeavors. The temporary nature impacts on the types of facilities provided for a peacekeeping force and on the way in which the force is supported. Planners generally design the facilities and the support structure to be adequate but austere.

Financial constraints. Because military budgets are shrinking worldwide, peacekeepers often operate under financial constraints. While budgetary concerns should not interfere with accomplishing the mission, financial limitations may require conservation of resources and innovative approaches to support requirements.



Waste-water treatment plant for the 2000 soldiers on the MFO's North Camp. Engineer planners must include ecological considerations when preparing to conduct peacekeeping operations. Degrading a host nation's environment will not make us "good neighbors."

Engineering Considerations

Threat level. The threat level in a peacekeeping force's area of operations is one of the most important factors in deciding how engineers will support the force. The local threat level impacts on the—

- Types of missions engineers will perform.
- Degree of hardening engineers will provide for facilities.
- Dispersion of critical assets.
- Basic manner in which engineers will conduct operations.

The threat level also affects the types of equipment and weapons (if any) that engineers will carry, as well as whether they will require external assets for job-site security. Threat levels vary widely, and every engineer soldier must fully understand the potential threat that surrounds him. For example, the environment in which the MFO currently operates is relatively benign, while peacekeepers in southern Lebanon face a considerably more hostile threat. Even in a historically low-threat area, however, the level of hostility may increase if tensions rise between the conflicting parties. Peacekeepers must continuously update their threat analysis. If tensions increase, engineers may be called upon to upgrade the security of base facilities, Construction materials should be stocked for this because rapid procurement may not be possible after the threat level rises.

While there is currently no significant threat in the MFO's area of operations, terrorism can strike anywhere. Basic force protection measures at MFO facilities include perimeter wire, security lighting, and continuous observation of site perimeters. The MFO operates in areas with a substantial local population, and a commonsense approach to applying these measures is required to ensure that civilians are not endangered. Being a good neighbor supports peacekeeping goals.

Operation Duration. While it is not possible to predict exactly how long a peacekeeping operation will last, planners can estimate an approximate duration. This planning figure affects the number and type of facilities that engineers will construct (ratio of purely functional to recreational facilities), the type of construction they will employ (tents versus wood-framed buildings), and the amount of effort they will put into building support facilities (fuel points, warehouses, motor pools, and so forth). Generally, the longer the projected duration of an operation, the more extensive and permanent the facilities will be. Other considerations may also place limitations on facilities. For example, diplomacy may dictate that a peacekeeping force maintain an appearance of nonpermanence to gain acceptance of their presence. Financial constraints on an operation may also limit the degree of facility development. Engineers should plan for a peacekeeping mission based on its projected duration but be prepared to extend operations indefinitely.

A peacekeeping mission with no specified end requires a balance between providing adequate support and conserving resources. The MFO was originally envisioned to operate for 10 years, and most facilities were built to last that long. The 10-year mark has passed, and the MFO continues to operate with no foreseeable termination date - but it could come any time. The engineering staff is faced with the question of whether each decision, project, and program makes sense within this context. On one hand, they *must adequately maintain their facilities. On the other hand, they have an obligation to the countries that contribute funding to spend their money wisely.*

Operation Maturity. The length of time that a peacekeeping operation has been under way impacts on the engineer support requirements. An incipient peacekeeping operation may have significantly different (and usually greater) engineer requirements than a well-established one. The correct mix of engineer equipment may differ for establishing a peacekeeping force than is required for facility maintenance. For example, it may be necessary to drill water wells, construct observation posts and base camps, and build heliports or airports while bedding down a force. Engineer units rotating to an established peacekeeping force should communicate with the unit they are replacing well in advance to determine the current status of facilities and what missions they should be prepared to execute.

Facility standards. The standard of the facilities that a peacekeeping force occupies affects the level of maintenance required for their upkeep. This, in turn, affects the structure of the engineer force that will support the operation. At one end of the spectrum, a force may occupy a "tent city" and use temporary facilities. These situations may require support from engineer construction units, as well as engineer detachments (prime power teams, well-drilling teams, fire-fighting teams, etc.). At the other extreme, a peacekeeping force may occupy relatively permanent facilities—albeit on a temporary basis. For example, the MFO's North Camp was built as an air base by the Israelis. A permanent installation may dictate deployment of engineer teams (and individual engineers) with expertise in areas normally found in directorates of engineering and housing (DEHs). The work force performing maintenance on peacekeeping force facilities in this situation may come from military units, contractors, the local populace, or a mix.

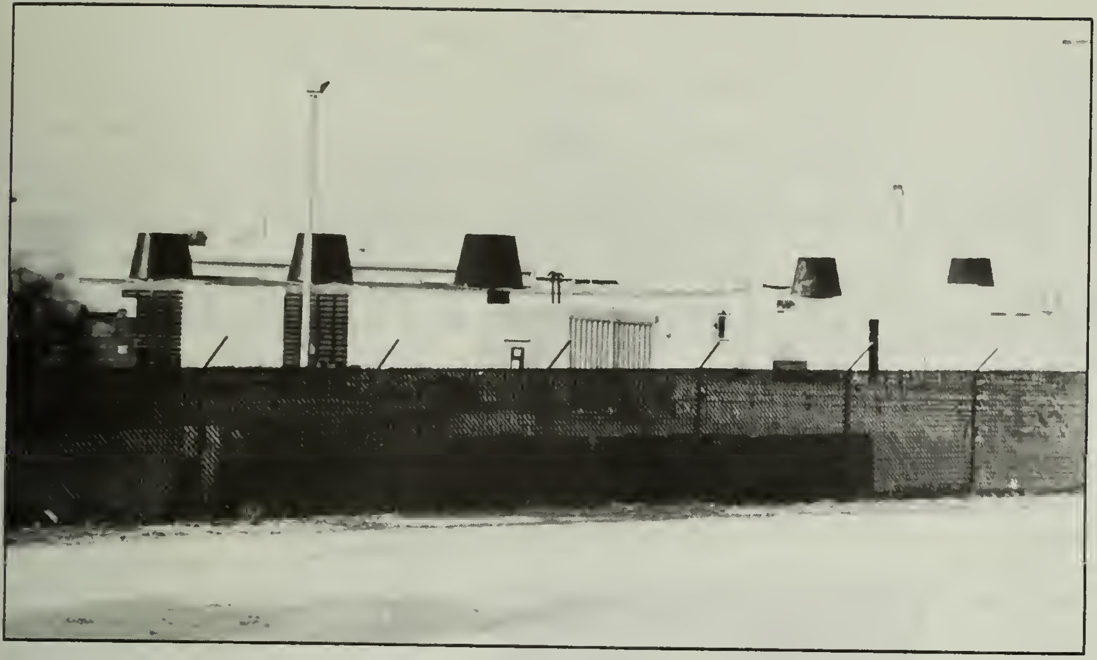
The MFO's billeting facilities range from prefabricated metal buildings (2-, 14-, and 19-man sizes) to three-story concrete barracks and three-bedroom duplexes. Offices, dining halls, and support activities occupy permanent and semipermanent structures. While these facilities are more comfortable than a tent city, they require more intensive (and expensive) maintenance. Supporting semipermanent sites in a remote area like the Sinai is much like running the public works department of a small city. The civilian support contractor provides dependable water supply, sewerage, and power. The multinational force and local contractors construct, maintain, and replace roads, buildings, and other facilities.

Age of facilities. The age of a peacekeeping force's facilities affects the amount of engineer effort needed to maintain them. Ongoing initial construction or the maintenance of very old facilities requires more engineering support than maintenance of a well-established operation that is only a few years old. As facilities age, factors such as type of construction, original design life, and the amount and quality of preventive maintenance impact on the effort required to keep them operational. Take, for example, a base camp designed to last 5 years (based on initial projections and diplomatic commitments). If the mission continues significantly longer, an increasing amount of resources must be devoted to maintaining the facilities, and this may conflict with financial constraints. In a stable peacekeeping environment, nations contributing personnel, equipment, or funding are likely to expect costs to remain relatively constant (or decrease) over time. Thus, engineers maintaining older facilities must become adept at low-cost repair and rehabilitation.

Local infrastructure. The degree of development and current condition of an area's infrastructure impacts significantly on engineer support to a peacekeeping operation. The current condition is as important as the degree of development—first-rate infrastructure may be rendered useless by the ravages of war. Power, water, roads, railroads, airfields, and ports are the most significant infrastructure components that influence engineer operations in a peacekeeping environment. These elements may be in good condition and adequate to support the peacekeeping force, or there may be no remaining (or previously existing) infrastructure. Because resources are often limited, augmentation from engineers in the peacekeeping force may be required.

The MFO receives most of the water for North Camp through a pipeline operated and maintained by the government of Egypt. The local infrastructure can support the camp's water supply needs. However, due to the remote location of the camp and its power requirements, the Egyptian power grid cannot meet the camp's electrical demands. Six 1.2 megawatt Electromotive Division (EMD) diesel generators supplied by the U.S. provide the necessary power.

Local support. Construction materials, facility repair parts, and labor (both skilled and unskilled) may be available locally to assist engineers as they support a peacekeeping force. The level of residual hostility in the region will affect the amount of commerce and interaction that occurs between the local populace and the engineers. Additionally, the location of the operation will influence the cost, quality, and availability of materials. Standards and quality will vary, but engineers must be prepared to adapt to and use local materials. This is especially true for bulky items such as cement, brick, block, timber, and plywood



MFO North Camp's power plant can produce 7.2 megawatts. These six Electromotive Division diesel generators are Vietnam-era units provided by the U.S. government. Switch gear and control apparatus allow plant operators to run from one to six units.

because transporting them from home countries may be cost prohibitive.

Working with Egyptian engineering contractors is an eye-opening part of an assignment with the MFO. We in the western world tend to take the availability of engineer equipment for granted. In the eastern Sinai Peninsula, manual labor often replaces equipment. Egyptian contractors make sizeable concrete placements using small mixers (about the size of the U.S. Army's 16S mixer) and laborers who transport the concrete with wheelbarrows. While their techniques differ from the mechanized methods common in the U.S., the Egyptians efficiently and effectively get the job done. Time and time again, they demonstrate innovative "low-tech" solutions to daily engineering challenges.

Prioritization of requirements. During many peacekeeping operations (as in other situations), requests submitted by supported units exceed the capabilities of the assets available to the engineer planner. Allocating critical assets (materials, man-hours, and equipment-hours) takes on new dimensions when the choices affect different units and different nationalities. Engineers must be sensitive to this fact and ensure they do not create the appearance of favoritism. Planners must review all requests for support, ensure they are clearly defined, and identify the resources required to fulfill them. They must then evaluate the requests based on their importance to the requesting units (keeping in mind that cultural considerations may increase the relative importance of a request) and to the overall peacekeeping mission. After the engineer planners have considered those factors, they can prioritize the requests relative to other outstanding requirements. When possible, engineers should explain to their supported units why requests have been denied. Developing open lines of communication and positive working relationships with supported units contributes to an improved atmosphere within a multinational force.

Conclusion

Because of their importance to world and regional stability, the U.S. will continue to contribute to and participate in peacekeeping efforts. The advantages that accrue from multinational peacekeeping operations make them more likely to occur than unilateral efforts on the part of the U.S. This article may assist engineers as they plan and execute support for multinational operations. These considerations, however, are only a starting point. Each operation is unique due to its location, the belligerents involved, and the nations contributing forces. Unique situations generate both customary and unusual requirements, both of which must be addressed with imagination and innovation. The most important advice for engineers planning these operations is to keep an open mind and take nothing for granted. While many challenges are involved in these operations, there are many opportunities for personal and professional development.

Major Houck is assigned to Fort Hood, Texas. He most recently served as the Deputy Force Engineering Officer for the Multinational Force and Observers in the Sinai, Egypt. Previous assignments include Regimental Engineer, 2nd Armored Cavalry Regiment and Commander, B Company, 94th Engineer Battalion. He is a graduate of the Command and General Staff College.

Interview with
Major General Daniel Christman

Q: *We've heard military leaders speak about many changes within the Department of Defense. In your opinion, where is the Engineer Branch heading?*

A: First, let me say that the future for the Engineer Branch is very bright. Like the rest of the Army, the branch is getting smaller. Further, our branch will rely on the Reserve Component (RC) to a degree unusual in other combat arms; even now, almost three-quarters of our force is in the reserves. However, more and more our country is witnessing and recognizing the importance of the Engineer Branch in all forms of endeavor, both on the battlefield in war and in operations other than war. The success of our branch in Somalia especially highlights that. We are a national asset, equally valuable in peace and in war.

The other reason why I say the future is bright is that our branch is now recognized as a vital, integrated member of the combined arms team. We saw that emphasized repeatedly by senior leaders from our maneuver corps and divisions who spoke during the SELTC (Senior Engineer Leaders' Training Conference) in April. Each of them highlighted the roles of engineers as vital contributors, side by side with infantry and armor, field artillery, and aviation. That contribution and the recognition of that contribution will continue without question because of the success we've enjoyed in recent combat operations and at our combat training centers.

Q: *What would you say are the most important initiatives currently affecting engineers in the field, within the Engineer School, and at the Department of Army (DA) level? Specifically, what will be the role of engineers in the combined arms arena?*

A: Let's break that question into three parts. In the field, two initiatives stand out. One is the continued employment of engineers in operations other than war, as highlighted by the Hurricanes Andrew and Iniki and Restore Hope Operations. The support that engineers provided in those operations gave our branch, indeed our entire country, a picture of engineer capabilities that is as old as the nation. Those experiences reflect our involvement in humanitarian relief and construction in the most positive manner possible.

The other initiative I would highlight in the combat arena is an important development with respect to equipment—and that concerns the M1 tank. Last December, several divisions recommended that we replace the combat engineer vehicle (CEV) with an M1 tank in the heavy divisions of our force to provide breaching capabilities and improved mobility. I fully supported that initiative, and the Vice Chief of Staff of the Army endorsed it in May. This initiative, in essence, will replace the CEV with an M1 tank equipped with a track-width mine plow or mine roller in virtually all Active Component (AC) combat engineer battalions. This is a very positive development because it underscores the point I made earlier: it solidifies the

Interview by Catherine Eubanks
Managing Editor, ENGINEER Professional Bulletin

engineers' role in the combined arms team as a vital and continuing contributor.

In the schoolhouse, one important development continues to be doctrine writing. We are participating fully in the DA initiative to draft a new field manual that describes support to U.S. civil authorities, called FM 100-19. It is scheduled for publication in July. We are using lessons learned from our experiences in Somalia and hurricane relief efforts to provide the right engineer perspective to that manual. It, in conjunction with FM 5-114, *Operations Short of War*, and other companion documents, will present good intellectual and operational "grist" for Army commanders tasked to perform similar missions in the years ahead.

At the DA level, the critical initiatives include support for ongoing equipment modernization efforts, principally in the minefield breaching arena; the topographic arena; and sustainment engineering equipment, principally tactical construction equipment.

Q: *You mentioned how important RC units are to the total force. What do you see as the evolving role and changing missions for RC engineer units?*

A: Earlier I mentioned that reserve units make up 75 percent of the engineer force. So, I must emphasize that RC soldiers are completely integrated into the Army's total force planning effort for engineers. Most RC engineer activities focus on what we call "echelons above division." We see that most visibly in our combat heavy battalions, the bulk of which are RC units. The real change for RC engineers, however, will be in *when* they are needed. Many missions now almost totally in the RC were, until a year or two ago, performed at the division level. Bridging is one example. Assault float-bridge companies and medium-girder bridge companies, now predominantly in the RC, may well be among the first units deployed in future contingencies. This means that selected RC engineer units, to include combat heavy battalions, must maintain their readiness levels as high as possible. These units must realize they may be among the first called in future overseas activities or to disaster relief or humanitarian missions in the U.S. That's what our Chief means when he says, "Everyone is deployable."

> **"Our challenge is to minimize the impacts of budget reductions on training and to divest activities that do not relate directly to the training mission."**

Q: *Let's go back to engineer doctrine. How do you see our doctrine evolving in response to changing world events?*

A: Let me answer that by first describing where I think the Army is going. Our new Army capstone field manual, FM 100-5, *Operations*, is scheduled for publication in June. It contains valuable information regarding operations other than war, especially disaster assistance, humanitarian relief, and peacekeeping operations. That emphasis in the Army's capstone manual will eventually be reflected in the Army's branch manuals, such as FM 5-114. In effect, the evolution of branch doctrine will reflect the evolution of Army doctrine. Army doctrine will continue to focus, as it should, on war fighting. But it will give more attention, because the public demands it, to roles we perform throughout the operational continuum, such as humanitarian relief and disaster assistance.

Q: *The Army's budget and manpower resources have been reduced by about 25 percent and more reductions are projected. In your opinion, how will these reductions affect Army missions, training, and readiness?*

A: Our goal, of course, is to minimize the impacts of budget reductions on training and readiness. The Chief's primary goal is to assure that our Army remains trained and ready in the decade ahead—in spite of the budget reductions just described. The Army has taken the bulk of those reductions to this point in force structure and modernization, so that dollars could be plowed back into training.

There is clearly a limit to how far we can go in that direction without some impacts on training. I would be less than candid if I didn't say that we see some impacts already. For example, we've had to cancel field training exercises (FTXs) in certain MOS at the Engineer School. We have also reduced training support in areas such as motor transport. We're trying to reduce the training budget intelligently so we can continue to provide commanders in the field with trained and ready soldiers, who will contribute solidly to their collective training goals.

Again, our challenge is to minimize the impacts of budget reductions on training and to divest activities that do not relate directly to the training mission. We've done that already by reducing overhead in the installation support arena. But we must have the guts to raise a red flag if the cuts go too far. We must tell our senior leaders, "Time out— this is beyond the point where we can absorb further reductions." Something must be done to protect the Army's basic interest—and that's our training mission.

Q: *Can you give a few examples of items cut from the Engineer School's budget?*

A: Sure. At Fort Leonard Wood we have significantly reduced the cost of doing business in club activities; we've almost totally eliminated support for the horse stables and rod and gun clubs, which formerly were funded with non-appropriated dollars. Instead, we've plowed that money back into installation support areas normally funded by taxpayer dollars—in particular, sports programs that would have been cut to the bone by the reductions in appropriated funds. We've also consolidated our dining facilities and reduced grass cutting and janitorial services. All of that was done to preserve our corps' mission—to train soldiers.

Q: *Can we still provide a high quality of life for soldiers in spite of those cuts?*

A: Yes. The Army recognizes that training and readiness involve more than simply rounds down range. Training and readiness include the quality of life for soldiers. That means barracks that are well maintained, clean, and equipped with modern furniture. It means housing areas equipped with modern conveniences and appliances, where families can live safely. The Army's budget priorities now reflect that total emphasis on soldiers' quality of life, and that's all to the good.

Q: *With the trend toward decreasing resources, what do you see changing in base operations functions, specifically with regard to Directorate of Engineering and Housing (DEH) responsibilities? For example, do you expect more combat heavy units to be used in base maintenance operations?*

A: Yes, combat heavy units and combat support equipment companies, which are similar in terms of their horizontal construction capabilities, will be used increasingly in base maintenance operations. It's a fact of life.

Increasingly, DEHs throughout the Army will be financially constrained. In fact, their O&M (operations and maintenance) accounts are already pared to the bone. Fewer dollars are available for day-to-day base maintenance, which is their "seed corn" for future infrastructure vitality. One way the DEHs can get by with decreased O&M budgets is by using the TO&E (tables of organization and equipment) engineer units just highlighted—the combat heavy and combat support equipment companies.

Our challenge, as a branch, is to ensure that when units perform those functions, they do it in a METL-related context. They must try to limit themselves to missions that have a direct bearing on what they will do in time of war. In most cases, that's fairly easy. Range road maintenance, hasty repair of buildings and grounds, and cantonment layout are examples where installation commanders have called upon engineer units to execute peacetime missions on their posts that are directly related to missions they would perform in time of war. We need to insist, though, that units be provided an opportunity to deploy. Most installation commanders I have talked to are sensitive to the need for regular deployment exercises. Obviously, "deployment" skills will deteriorate if training is devoted exclusively to installation management, and we must ensure that does not happen.

Q: *In light of the recent decision to allow women to fly combat aircraft, when do you expect the remaining combat engineer MOS to be opened to women? Do you expect this decision to affect training standards for engineer soldiers?*

A: First, let me applaud the decision by the Secretary of Defense to open more positions in the armed forces to women. It's a positive development. It's consistent with the initiatives we took a year ago to open more positions in the Engineer Branch to females. We opened all bridge companies and the ERI (engineer restructure initiative) brigade headquarters and headquarters detachments to female officers. The only exception is the brigade commander's position, which remains closed. How far the Army will go beyond the initiatives outlined by Secretary Aspen is a question that the Chief of Staff and senior leaders in the Army are wrestling with now. I expect to weigh in shortly with my view on the branch to General Franks, at TRADOC. His staff recently asked for our recommendations.

My bias on this issue is to be inclusive not exclusive, and to open additional opportunities for females in the branch wherever we can. We are now collecting input from the leadership of the branch and the school to provide a response to TRADOC. Regardless of what happens in TRADOC, however, I expect that the trend toward opening additional opportunities for women, as highlighted by Secretary Aspen's announcement, will continue throughout our armed forces. Again, that's a very positive development. And it will not affect training standards!

Q: *Some soldiers have expressed concern about the Army's education system, especially training for engineers. Can you provide some insight into where the education system is headed with regard to engineer NCOs and officers? Are there plans to expand NCO training to make it more parallel with officer training?*

A: I think the basic structure of the education system is sound and is unlikely to change in the near term. The NCO system that we have grown accustomed to over the past 10 years (PLDC, BNCOC, ANCOC, and the Sergeants Major Academy) works splendidly. The officer education system is being tweaked on the margins but is unlikely to be radically altered. What we have tried to do at the Engineer School, though, is to ensure consistency in the kind of training offered at the Libby NCO Academy and in officer courses in Lincoln Hall. Our NCO Academy was reaccredited last February by TRADOC. One area that we worked on as part of the reaccreditation effort was to ensure consistency across the board in areas such as mine/countermine operations and engineer battlefield assessments. Feedback from field personnel and students indicated that, in those areas especially, NCOs and officers were not being taught consistent doctrine or procedures. Now there is one standard, and we're operating from the same updated field manuals throughout the school.

What will further improve the situation is the movement this summer toward a consolidated Directorate of Training (DOT) in the Engineer School. That directorate will have responsibility for all training—officer, NCO, and enlisted. Consolidation will both standardize instruction to ensure the same doctrine is being taught, and enhance opportunities for shared training in situational training exercises and simulations.

Q: *Do you expect shared training to expand in the future?*

A: Shared training has increased significantly in the last few years, and we'll look at every opportunity to provide more. Whenever we bring student officers and NCOs together, feedback is extremely positive. That's true whether they are together for a social event or an FTX. The problem is simply one of scheduling. We are trying to provide students more opportunities to read, relax, and enjoy the Ozarks, especially on weekends and holidays. Can't do that if our goal at the same time is to maximize shared training across the board. So we're trying to strike a balance. I expect shared training to increase a little, but we've just about reached the limit without sacrificing some quality of life.

Q: *Are there plans to increase combined training for AC and RC units?*

A: The Army is doing that already in our combat training centers (CTC). When I visited the JRTC (Joint Readiness Training Center) last year, a corps wheeled battalion from the South Dakota National Guard was training next to the 25th Division from Schofield Barracks, Hawaii. It worked extremely well. That's the model, it seems to me, for training in the future. We will use the CTCs to collectively train and integrate RC units more and more into our Army's "go to war" preparations.

Q: *Is there any interest in increasing joint training between services? Can you explain the impacts of joint training between, for example, Army and Marine engineers?*

A: In the Engineer School we have had a joint training agreement with the Marines for years. They send Marines to virtually every officer advanced course, and we train enlisted Marines in Brown Hall. We expect that training to continue—both services love it, and both Army and Marine engineers benefit from the experience. Colonel Flowers, Director of Training, is exploring a parallel initiative with the Navy, to see if we can capture a similar program with the Seabees. That exchange would provide Seabees in our school and vice versa.

The impacts of joint training on the Engineer Branch are significant. Several studies, including one recently commissioned by General Colen Powell, Chairman of the Joint Chiefs of Staff, examine roles and mission issues with respect to engineers on the battlefield, especially responsibility for the joint training of engineers in all services. Even as I speak, an examination is under way to determine the cost effectiveness of having Fort Leonard Wood, for example, assume responsibility for some element of engineer training for all services. That could mean that Air Force, Navy, Marine, and Army heavy equipment operators would be trained here, if the initiative is proven to be cost effective. We're working the numbers now and expect some preliminarily assessments in the very near future.

I don't see that initiative changing the role of the Engineer Branch as we know it. For example, the initiative would not eliminate the Corps of Engineers as a combat branch or eliminate the Air Force Red Horse and Prime

Beef units or the Navy Seabees. Each service would maintain its engineer capability. But we would look for ways to enhance joint training as a means of saving dollars.

Q: *A benefit of joint training is that engineers would find it easier to work together in joint operations. Is that where you see the real payoff?*

A: Yes, down stream that's exactly what's at stake for those who desire joint training. In addition to potential dollar savings, it's the realization that, if you train together early in your career, it will be far easier to work together later, when a contingency might demand it.

Q: *The Corps of Engineers has been appointed the Army's proponent for environmental awareness training. What do you see as the role for the Engineer Branch in this arena?*

A: The Engineer School has been asked by TRADOC to develop a training support package for environmental awareness. We have worked with TRADOC under an "umbrella contract" to flesh out the details for awareness training. The intention is that everyone in the Army, whether a junior private or a senior maneuver commander, must acquire an increasing awareness of the role that environmental sensitivity and protection must play in all they do.

I don't envision that the school's responsibility will entail the technical aspects for environmental cleanup and restoration. That responsibility belongs elsewhere. The Engineer School is limited to providing awareness training across the board, and that is where I intend to keep us focused.

Q: *Earlier you mentioned the Engineer School's reorganization. How will it affect the quality and kinds of training provided to engineer soldiers?*

A: I've already discussed the most important element of the reorganization, and that's the creation of a single Directorate of Training. But other school initiatives are also important. One is the creation, in effect, of a Director of Proponency, which pulls the Engineer Personnel Proponency Office under the Directorate of Combat Developments. So, that directorate now has equipment and personnel proponency in its domain.

> **"Everyone in the Army, whether a junior private or a senior maneuver commander, must acquire an increasing awareness of the role that environmental sensitivity and protection must play in all they do."**

We also eliminated the position of deputy assistant commandant. Now each principal directorate in the schoolhouse—Combat Developments, Training, and Evaluation and Standardization—will report to the assistant commandant with no intervening layer. This change is reflective of a TRADOC school model that most other schools have adopted.

Q: *We've heard that some MOSs may be consolidated for efficiency. What is the Engineer School doing in that area?*

A: Well, the biggest issue we wrestled with last year was the proposed consolidation of the 12-series MOS. That action would have consolidated the 12B, 12C, and 12F MOSs into a combat engineer MOS, notionally called "12B." We cancelled that effort because feedback from the field was strongly against it. Must also say that trying to overlay a training requirement for the 12Fs, who would have to man and fight the M1 breacher while also being skilled in bridging and basic combat engineering, didn't make sense. So we will not combine the 12-series MOS.

We're still looking at the 51-series MOS for possible consolidations. In fact, we've created a new, consolidated 51T MOS that brings together soils, draftsmen, and surveyors from the old 51G, 81B, and 82B areas. We're also consolidating the photo layout and printing MOSs, (83E and 83F). These initiatives are under way and make good sense. That's all the MOS consolidations I can see in the near term. We will continue to look for opportunities to save but will not go into any initiative blindly.

Q: *When you came to the Engineer School, you wanted to concentrate efforts on improving engineer equipment. What strides do you feel we've made in this area?*

A: We have some genuinely good news here! It is difficult to see short-term results in this area because of budgeting and because equipment modernization systems take so long to develop. However, we completed an extremely successful functional area assessment (FAA) last fall. School staff went to Washington to brief the Vice Chief of Staff for the Army, and we came out of the FAA in very good shape. For example, we initiated a funding line for a new, light bulldozer, called the "Deuce" (deployable universal combat earthmover), to equip our light and airborne divisions. Equally important was an agreement to "plus up" our tactical construction equipment line. The goal is to sustain roughly $25 million annually for equipment purchases in areas that badly need updating—for example, compaction equipment and cranes.

The vice chief also supported some critical topographic enhancements, especially the purchase of a TIIP (Topographic Imagery Integration Prototype). It will allow us to process commercial satellite imagery for use by military commanders at the corps level and below.

Last but not least, we received continued funding for the engineers' most important combat mission, minefield breaching. The M1 Breacher and the M1 Bridger both received strong, enthusiastic support. And I would add that providing M1s to the Active Component to replace the CEV, and recognition by TRADOC and DA of the need for engineers to be equipped with the M2 Bradley fighting vehicle as an engineer squad vehicle, are significant developments even beyond the positive outcomes of the FAA. Those items are very good news for the engineer force. Hopefully, my successor or his successor will see that equipment in the field before this decade is gone.

Q: *What are the major benefits of switching to the M1s and M2s?*

A: First and foremost, this change provides the engineer force with equipment that allows us to attain equivalent battlefield mobility. This is particularly true with the M1. Secondly, the M1 gives the engineer and the engineer element of the task force a breaching vehicle. The CEV is not a breacher but the M1 with a track-width mine plow is. So we will have, with engineer supervision, an armored platform whose primary mission is to assist in breaching complex obstacles, and that's a very important development.

The principal advantage of the M2, the Bradley fighting vehicle, is that it provides survivability for engineer squads on the battlefield comparable to the survivability afforded to infantry members of the maneuver force, with whom we work. Right now engineers use the M113. It is a fine piece of equipment but has significantly fewer survivability characteristics than does the M2.

Q: *What do you see as the Engineer School's greatest achievements during your tour here as commandant?*

A: I am proudest of the recognition we have received and continue to receive from senior maneuver commanders at division and corps levels for our role in the combined arms fight. The SELTC, in April, showed that. The briefings we received from General Wesley Clark and General Carmen Cavezza underscored how engineers have been recognized as true members of the combined arms team, working side by side with other elements of the maneuver force to achieve decisive victories. And that's the element that I believe is our proudest achievement, not just during my time as commandant but during the stewardship of many commandants before me.

Would say that one of the most moving achievements during the 24 months of my stewardship was the commitment we made to restore hope to the people of Somalia. The Engineer School sent a seven-soldier engineer team along with mobile training teams to Somalia last winter and early spring. Welcoming home those soldiers to a thunderous ovation from the installation and the community was a moment of great pride for the installation and the branch.

Q: *As you move forward in your Army career, what do you think will be some of the major challenges facing General Ballard, as your successor?*

A: Joe Ballard will face the same basic challenge that Dan Schroeder and I faced here. Dan Schroeder brought the school from Fort Belvoir to Fort Leonard Wood. But he also had the first glimpse of what a steeply declining budget means to a large installation such as this. That's been my greatest intellectual challenge—to continue the downsizing effort here in a way which does not break faith with the Army's imperative "trained and ready." So one major challenge that Joe will face is the continued accommodation to the budget realities of this decade.

A second challenge is to continue equipment modernization for the branch. We've had some great successes in the past few years in highlighting the importance of equipment modernization for combat engineers. The road ahead will be rough because the research, development, and acquisition funding account will take, in my view, more and more hits. Joe will be forced to continually defend those programs that are vital to the branch's future. That will mean prioritizing what on our list is a keeper and what, as the budget continues to be shaved, we might be willing to let go. We must compromise on some things and protect the most important elements of the modernization piece. Big task.

Q: *In closing, do you have any words of advice for young soldiers coming into the engineer force?*

A. I would say, "Come on in and join us!" It's a great branch. The diversity of the Engineer Branch has been a hallmark of our corps since 1779 and will remain a characteristic of the branch for decades to come. You can see that by reviewing what we have done just in the last three years—Desert Storm, hurricane and disaster relief, and humanitarian assistance to Somalia. There are enormous opportunities out there for any young man or woman who wants to join the most exiting branch in the Army. Essayons!

Notes from the Commanding General

To: Members of the Engineer Regiment

Following Secretary Aspin's announcement regarding expanded opportunities for females, I provided the attached memo to General Franks, TRADOC, outlining the position for combat engineers. Believe this position is consistent with Secretary Aspin's goals and will expand opportunities for women in our branch in a manner fully consistent with the enormous strides we have made as members of the combined arms team. Hoo-ah!

Subject: Women in combat

1. Sir: [MGs] Den Malcor and John Herrling have been keeping me in the loop on status of DOD study group regarding women in combat. Understand you may be asked for TRADOC position on associated policy issues. Want to give you the view from my lane on combat engineers.

2. Testified last year to the Presidential Commission on the assignment of females. Told the commission my bias is to be inclusive, not exclusive; believe we should do away with the current DOD "risk rule" based on location on the battlefield and open all MOS in the Army. Entry into an MOS would be based on aptitude evaluations, plus an assessment of strength and endurance. (FYI: Don't believe this is a big deal; Canadian Army experience indicates very few females will volunteer—instincts are we'll move beyond any "start-up" problems very quickly.)

3. However, recognize Chief and SECDEF are not contemplating wholesale removal of gender-exclusion rules. Thus, under current rules, recommend we open our MOS 12C (bridge crewmember) to females. Female officers already serve in bridging units. Further, bridging units do not meet the conditions for female exclusion under a broad interpretation of current coding. More difficult are MOS 12B (combat engineer) and MOS 12F (engineer tracked vehicle crewman). My view in a nutshell: If MOS 11B (infantryman) is opened, then open MOS 12B; if MOS 19K (M1 armor crewman) is opened, then open MOS 12F. Otherwise, keep 12B and 12F closed for the time being. Not withstanding my views in para 2, above, don't want to lose close association engineers have developed with our infantry and armor branches.

4. Believe approach with 12Cs consistent with the broad thrust of SECDEF goal, reflected in [MG] John Herrling's last profs: "Continue to look at possibilities of opening more opportunities to women." Stand ready to elaborate on any points you wish. Would add one thought in closing: Believe Army should implement gender-neutral strength and endurance tests for all MOSs. This is clearly encouraged in AR 611-201, para 1-11, and would provide a more objective basis for selection policies under any expanded regime.

Thanks for hearing me out. My senior NCOs, including ECCSM Roy Burns, fully on board. ESSAYONS, Dan Christman.

Personal Viewpoint

Taking the Lead Without a Division Patch

Reality Check

I can still remember the commandant's question at the battalion precommand course: "How many of you are going off to command a nondivisional battalion at a division post?" My hand, along with the hands of about four others, went up. "Well, let me tell you about your OER. Best you can do will be a two block; don't be shocked at a three block. That's the way it will be." Our hands slowly went down as the divisional guys smiled at their first kills. He was partially right; most FORSCOM patched units do become odd man out at OER time. But it does not have to be that way. It depends on you.

A few weeks ago all of this came back when I was giving a leadership seminar to the officers of a "nondiv" battalion. It was during the question and answer period. Every other comment was the we-they type ending with a "we're nondivisional; we're out of it. There is nothing we can do except go straight to FORSCOM; maybe write General Christman a letter." You could do that and you would be within your rights. However, you will end up dead right.

In fact, let me give you four other sure-fired ways of going down in flames. The first one is to whine and run to FORSCOM—something the division staff really enjoys when it means they must respond to an end run.

- ***Use your mission essential task list (METL) as a reason why you can't participate.*** While you are at it, you might as well hang a sign on your back saying "kick me." All units have METLs and none of them list the hundreds of actions that need to get done to survive on a post. You are no different.
- ***Define your training needs as being only collective-level training performed off post.*** No one likes a prima donna; we all would like to train at the best locations with the best resources but we can't. Leadership comes forth in meeting challenges. Be a team player and think combined arms, small-unit tactics, and backyard training; or add an exclamation point to that sign on your back.
- ***Compete head-to-head with the divisional units.*** Of course it's their turf, rules, and resources. You will be remembered—perhaps as a war hero but definitely as an egotistical leader who sent his unit through a lot of trouble to come out on the losing end.
- ***Fight post taskings without providing realistic alternatives.*** No one wants to perform post duties and you should not be the doormat for all the "hey you" details. But don't be the open sore, either. Carry your load, plus, and when you can't do a tasking, work to solve it.

Is This Getting Close to Home?

Let's review the bidding to see if the combat boot fits. You, as the battalion commander, are senior rated by the division commander. Your battalion is part of a uniquely named support brigade that is made up of other nondivisional units, commonly referred to as "ash and trash." Your company commanders are senior rated by the brigade commander, an infantry or armor officer who longs for a "real" brigade. There are two dozen "hoo-ah" battalion commanders in the same senior rater chain but they all wear a division patch. Add to all of this the facts that post support is eating you up, your FORSCOM money does not filter down to you, taskings are killing you, and you get leftovers for ranges. Is this you?

I've run that gauntlet and am here to say that you can come out on top, nondivisional patch and all. It all boils down to a positive team attitude and some solid visionary strategy.

Strategy for Success—

- ***Align your priorities with those of your senior rater.*** Ask for his support form and read it carefully. Keep it handy and periodically check your alignment with him, not the reverse. Bring your rater into your decision-making circle and allow him to participate. He will quickly sense that alignment and will support you. Keep your priorities in check until you have covered your boss' priorities.
- ***Don't compete head-on.*** Determine your unique strengths and use them to support the division. When you compete head-on you will be forced to

(Continued on page 38)

By Colonel Herbert F. Harback

Advances in Mine Warfare:

Antipersonnel Mines

By William C. Schneck, Malcolm H. Visser, and Stuart Leigh

Dismounted combat engineers face an increasingly dangerous and complex mission as the effectiveness of antipersonnel (AP) mines continues to advance. Significant improvements in technology over the last 30 years have also made AP mines inexpensive and readily available. They now pose a major threat to combat engineers tasked with providing mobility support to dismounted units. As with other serious combat threats such as chemical weapons, the best way to counter these hazards is through realistic training and aggressive accumulation of knowledge. This article, the second in a series of three, addresses the AP mine threat and effective countermeasures.

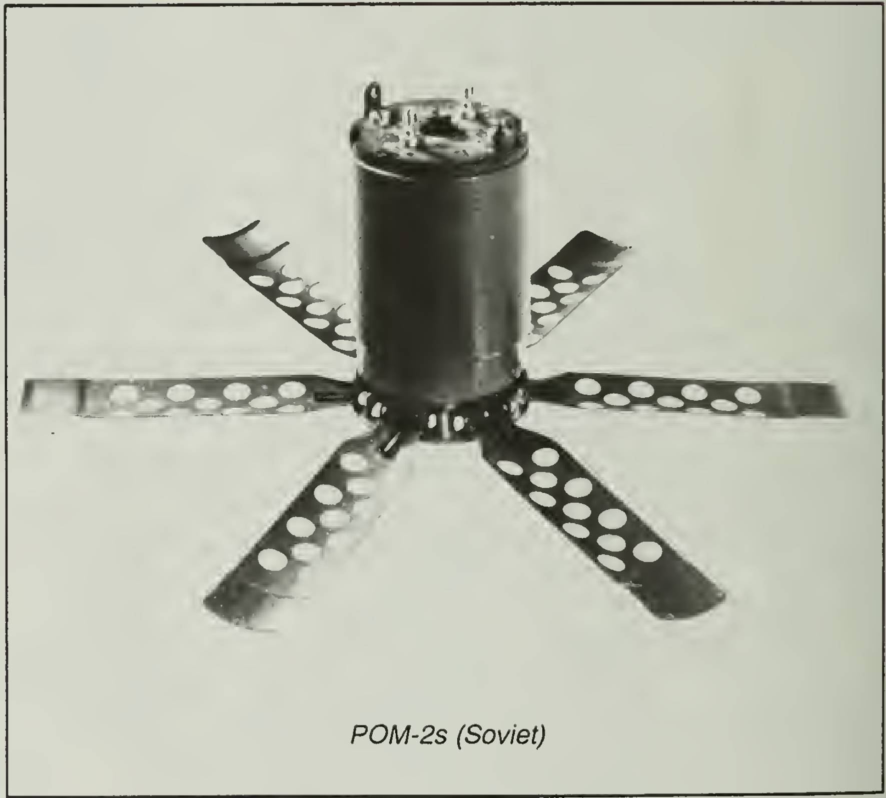


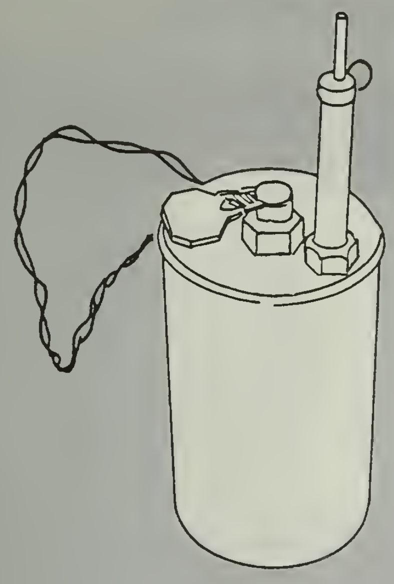
Figure 1. A scatterable fragmentation antipersonnel mine

Mine Threat

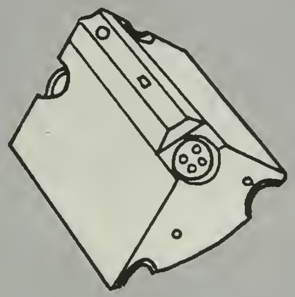
U.S. ground forces may encounter AP mines in any combat situation, regardless of climate, terrain, or enemy. In a mid- or high-intensity conflict, mines may be found in tactical and protective minefields. In a low-intensity conflict (LIC), AP mines may be almost anywhere. Typically, they are laid without pattern along roads and trails or as part of a belt of protective obstacles around an enemy base camp. In the LIC scenario, AP mines probably are the most serious threat to friendly units because of the numerous dismounted operations conducted[1] and because poorly equipped forces often rely on land mines as combat equalizers. AP mines have evolved into three general types: fragmentation, blast, and chemical.

Fragmentation AP Mines

The first land mines used in combat were fragmentation AP mines. Confederate soldiers improvised what they called "land torpedoes" from cannon balls and



OZM-3 AP mine (Soviet)



ADAM (U.S.)

Figure 2. Bounding antipersonnel mines

friction fuzes during the battle of Yorktown in the Peninsula Campaign of 1862.[2] From this crude origin, three varieties of fragmentation mines have evolved: bounding, like the U.S. M16 "Bouncing Betty"; directional, like the U.S. M18 Claymore; and simple fragmenting, like the Russian POMZ-2 stake mine or the scatterable POM-2s (Figure 1). In recent years, the addition of advanced fuzing has significantly increased the performance of each variety. All three types are inexpensive and readily available.

Dismounted soldiers must remember that many fragments remain dangerous well beyond the "lethal" range of these mines, even though the chance of being hit decreases as the distance from the point of detonation increases. The lethal range (or radius) of a fragmentation mine is the distance from the point of detonation to the point where there are still 0.5 fragment per square foot with 5.8 foot-pounds of energy.[3]

Bounding. The Germans introduced the first bounding AP mine, known as the "S" mine, in 1935.[4] All bounding mines developed since then use the same basic principle. When activated, a small propellant charge launches the mine to a height ranging from 1 to 2 meters, where it detonates. The lethal radius ranges from 15 to 30 meters, depending on the model (Table 1, page 28). One common bounding mine used throughout the world is the Russian OZM-3 (Figure 2). The U.S.-made ADAM is a more advanced bounding AP mine that can be scattered by 155mm howitzers to ranges up to 17 kilometers (Figure 2). It is particularly useful for disrupting operations in the enemy rear. A modified version can be hand emplaced as a pursuit-deterrent munition.[5]

When equipped with a simple trip-wire fuze, directional and bounding AP mines are devastatingly effective. Their performance can be enhanced further by incorporating more sophisticated fuzing. Three-pronged pressure fuzes such as the U.S. M605 and the Czechoslovakian RO-8, used mostly with bounding AP mines, have proven to be resistant to explosive breaching equipment such as the MIC-LIC and the bangalore torpedo.[6] Recently fielded fuzes employing such state-of-the-art technologies as seismic-influenced fuzing and breakwire circuits present a grave threat to dismounted troops.

The first seismic-influenced fuzes used extensively were the Russian VP series of mine control devices (Figure 3, page 29). They possess an advanced processor for target discrimination and are used with either the MON or OZM series of mines.[7] First widely employed by the Red Army in Afghanistan, these devices were particularly effective during campaigns in rugged, rocky mountain valleys.

Both the Russians and the French have fielded breakwire fuzes. These devices, which are based on the principle of collapsing circuits, can be

Table 1. Directional and Bounding Antipersonnel Mines

Origin	Type	Nomenclature	Fuze	Lethal Range (m = meters)	Lethal Arc	Number of Fragments	Remarks
U S.	Directional	M-18	Trip wire, command	50m	60°	700	Copies made by Chile, S. Korea, Egypt, S. Africa, and Pakistan.
	Bounding	M-16A2	Trip wire, command, pressure	30m	360°	NA	Copies made by Greece, India, and S. Korea.
		ADAM	Trip wire	6 to 10m	360°	600	Scattered by U.S. 155mm howitzers; Self-destruct: short-4 hours, long-48 hours.
U.S.S.R.	Directional	MON-200	Trip wire, command, breakwire, seismic	200m	15°	910	
		MON-100		100m	15°	405	
		MON-90		90m	60°	NA	Large, Claymore type.
		MON-50		50m	60°	455	Similar to the Claymore.
	Bounding	OZM-3	Trip wire, command, breakwire, seismic, pressure	25m	360°	NA	
		OZM-4		25m	360°	NA	
		OZM-72		25-30m	360°	NA	
Czechoslovakia	Bounding	PP-Mi-Sr	Trip wire, command, pressure	20m	360°	NA	
		PP-Mi-Sr II	Trip wire, command, pressure	20m	360°	NA	
Yugoslavia	Directional	MRUD	Command	50m	60°	650	
	Bounding	PROM-1	Trip wire, pressure	22m	360°	NA	
Italy	Bounding	VALMARA 69	Trip wire, pressure	27m	360°	1200	Used by Iraq.
		BM-85	Trip wire, pressure	20m	360°	1000	
		P-40	Trip wire	22m	360°	NA	
China	Bounding	Type 69	Trip wire, pressure	13m	360°	240	
France	Directional	MAPED F1	Command, breakwire, pressure	40m	60°	NA	
	Bounding	M1951/1955	Trip wire, breakwire, tilt rod	45m	360°	NA	
Germany	Directional	SM-70	NA	NA	NA	NA	
	Bounding	DM-31	NA	NA	360°	NA	

NA = Data not available.

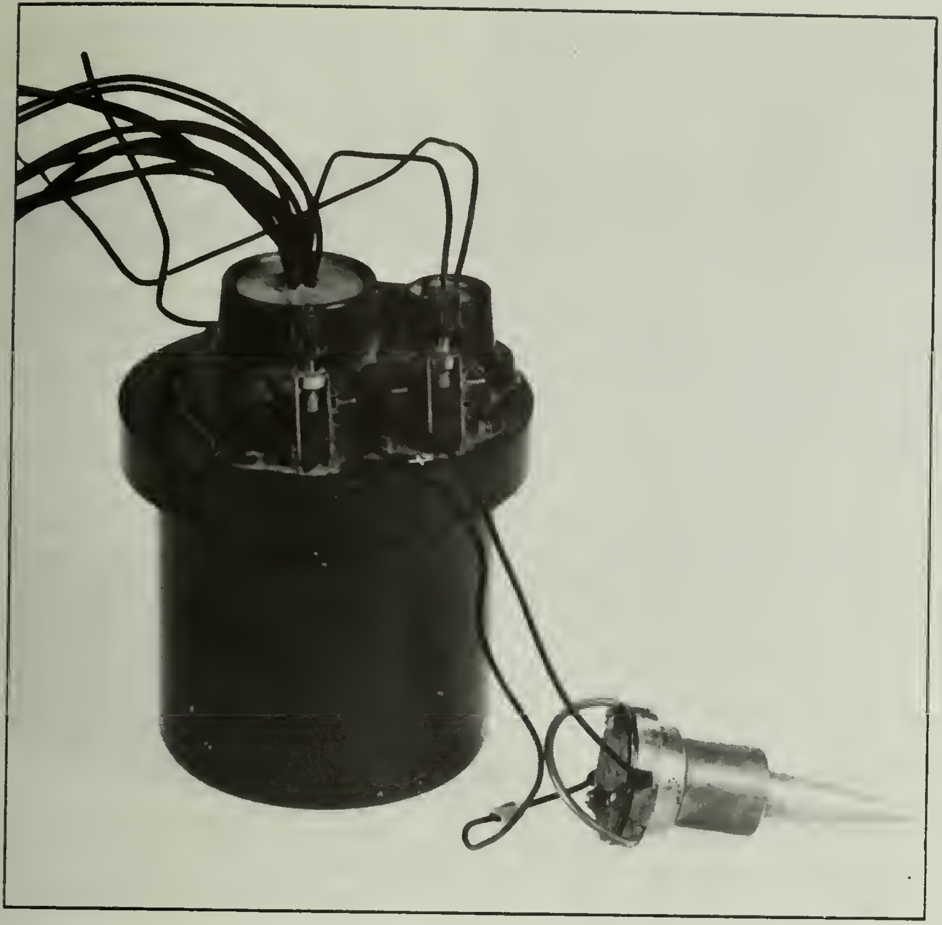


Figure 3. VP 04 AP minefield control device (Soviet)

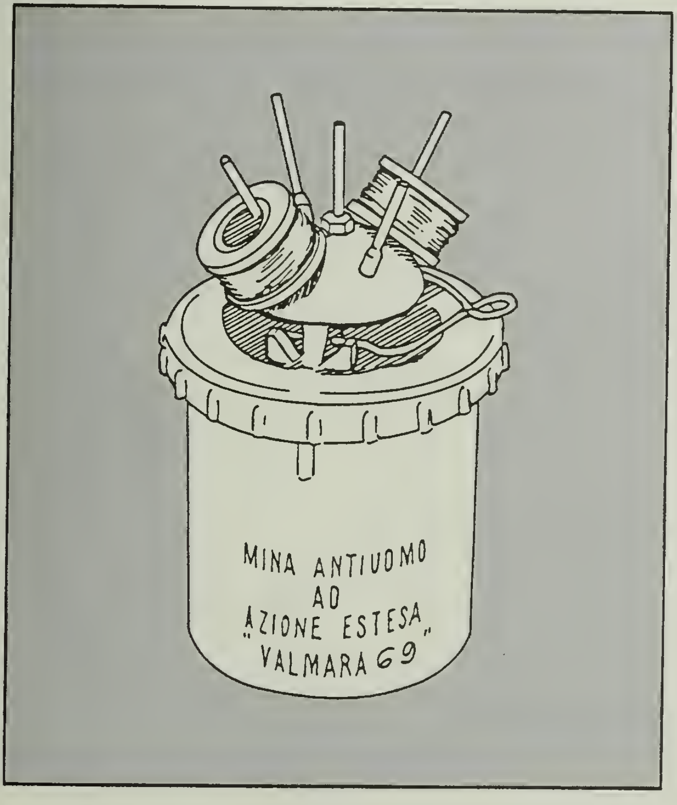


Figure 4. Valmara 69 AP mine (Italian)

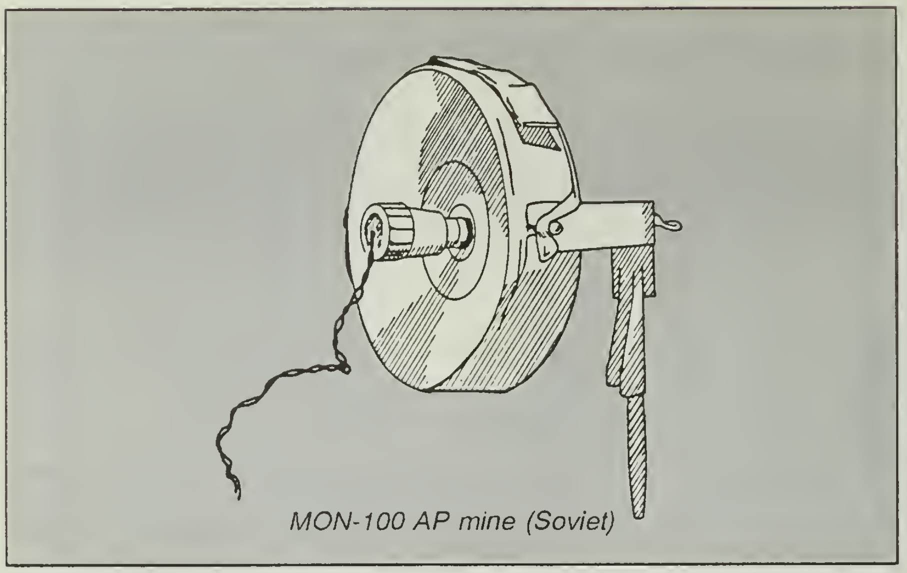
used with either bounding or directional AP mines. When the delicate "trip wire" is stepped on or cut, an electric circuit is broken and the mine is activated.[8] If the enemy is known to possess this type of device, soldiers must check both ends of any trip wire found before cutting it, regardless of whether it is slack or taut.

The Italian VS-APF1 is one of the most sophisticated add-on fuzes available today. It is an improved electronic fuze designed for use with the Valmara 69, a bounding mine employed in large numbers during the Persian Gulf War (Figure 4). The VS-APF1 has a 10-minute safe arming delay. After this delay, it dispenses three highly sensitive trip wires. It also has a field-programmable, self-neutralization device that allows the user to set neutralization times from 2 1/2 hours to 40 days. The mines can be recovered and reused after self-neutralization.[9]

Directional. The first U.S. directional AP mine, the M18 Claymore, was introduced during the Vietnam Conflict.[10] The Claymore has a lethal range of 50 meters and covers a 60-degree arc. Because of its wide attack angle and overall effectiveness, the Claymore has been copied extensively, and many countries around the world employ versions of it (Table 1).

Several nations have developed effective directional mines of their own. Two of the most noteworthy are the Russian-manufactured MON-100 (Figure 5, page 30) and MON-200. Both cover an arc of only 15 degrees but have effective lethal ranges of 100 and 200 meters, respectively. While some large Claymore-type mines have ranges approaching 100 meters, no other directional AP mine currently in use can match the long-range lethality of the Russian MON-200.[11]

Simple fragmenting. Simple fragmenting AP mines have been



MON-100 AP mine (Soviet)

Figure 5. Directional antipersonnel mine

employed since World War II without significant design changes.[12] Some of the better known examples include the Russian-made POMZ-2M and the Czech PP-Mi-Sk stake mines. This class of AP mines includes several scatterable mines, which can be deployed from such platforms as towed vehicles, helicopters, and fixed-wing aircraft.

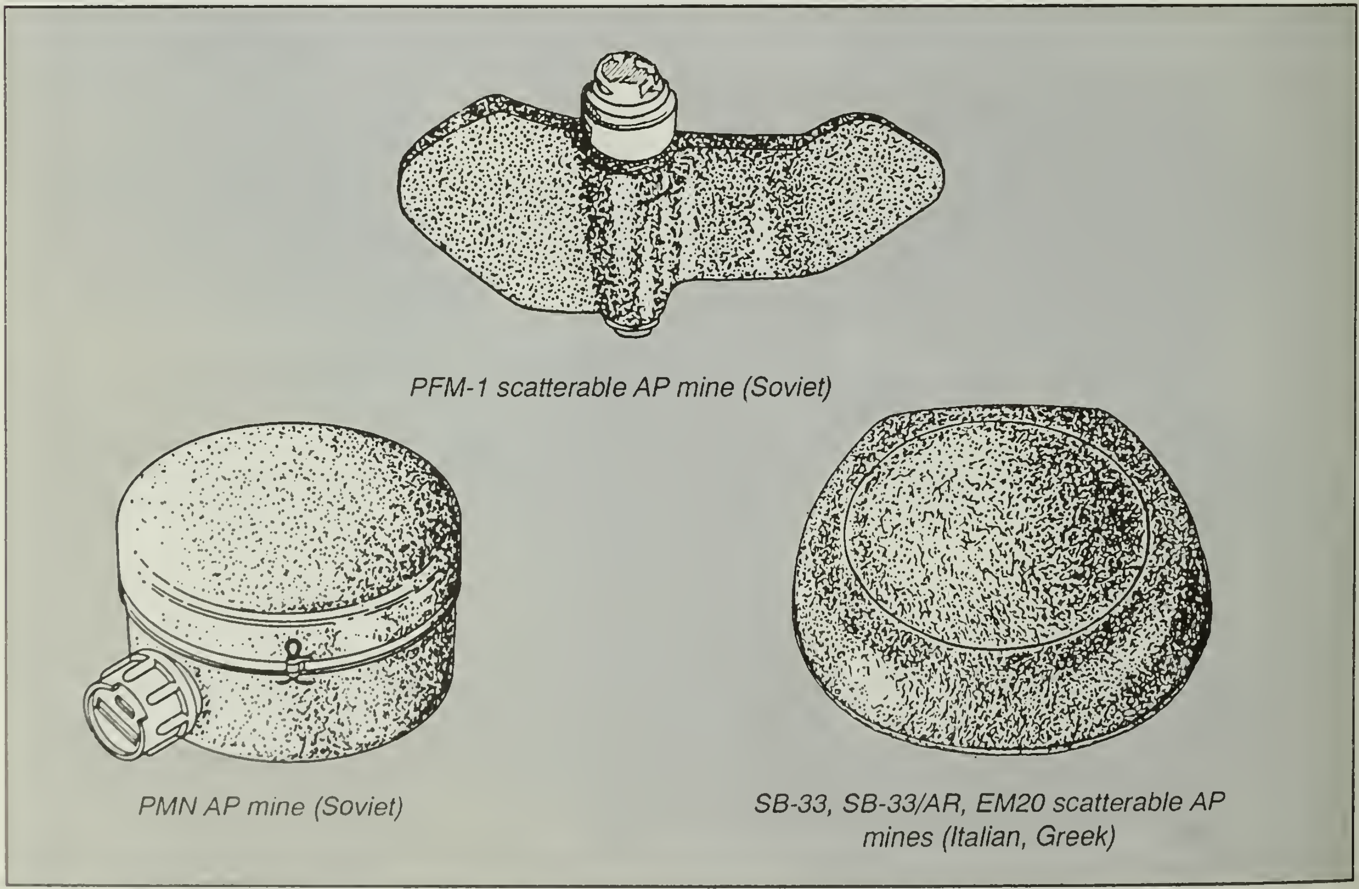
Blast AP Mines

Blast AP mines are produced by several countries (Table 2, page 31). They include the PFM-1 and PMN mines (Figure 6), which the Russians used so effectively in Afghanistan. Although these "toe poppers" are quite simple, several advances have been made over the years. Advances include the virtual elimination of metal, blast over-pressure protection, low operating thresholds, integral antihandling devices, scatterability, and self-destruct and self-neutralization options.[13]

The Italians have made the most significant advances in blast AP mines, with their SB-33 (Figure 6) and VS-MKII. The Yugoslavian PMA-3 is notable because it contains no metal. The most unusual blast AP mine is the Yugoslavian UDAR, which is a command-detonated, bounding, fuel-air explosive (FAE) device.[14]

Chemical Mines

Chemical mines typically are identified by their unique colors and markings. No significant



PFM-1 scatterable AP mine (Soviet)

PMN AP mine (Soviet)

SB-33, SB-33/AR, EM20 scatterable AP mines (Italian, Greek)

Figure 6. Blast antipersonnel mines

Table 2. Blast Antipersonnel Mines

Origin	Nonmenclature	Antihandling Device	Metal Content	Blast Protection	Emplacement	Remarks
U.S.	M-14	No	Low	No	Manual	
U.S.S.R	PMN-2	No	High	Yes	Manual	
	PMN	Optional	High	No	Manual	
	PFM-1	No, but very sensitive	Some	No	Fixed-wing aircraft, helicopter, mortar	
	PMD-6M	Optional	Some	No	Manual	
Czechoslovakia	PP-Mi-Ba	No	Low	No	Manual	
	PP-Mi-D	Optional	Some	No	Manual	
Yugoslavia	UDAR	No	High	No	Manual	Command-detonated bounding FAE mine.
	PMA-1	No	None	No	Manual	
	PMA-2	No	None	Yes	Manual	
	PMA-3	No	None	Yes	Manual	
Italy	SB-33	Optional	Low	Yes	Helicopter, manual	
	VS-50	Optional	Low	Yes	Helicopter, manual	
	VS-MKII	Optional	Low	Yes	Helicopter, vehicle dispensed, manual	
China	Type 72 A/B	Optional	Low	No	Manual	
U.K.	Ranger	No	Low	No	Vehicle dispensed	
France	M-59	No	Low	No	Manual	
	M1951	No	Low	No	Manual	
Germany	PPM-2	No	Low	No	Manual	East German origin.
	DM-11	No	Low	No	Manual	

improvements have occurred in their design in recent years. Only the U.S., the People's Republic of China, and the former Soviet Union are known to have produced them.[15] However, it is easy to convert a mine (usually antitank) from blast to chemical: the manufacturer need only remove the main explosive charge from the blast mine and replace it with the desired chemical agent. This retrofit can be readily accomplished in the field.

Booby Traps

Booby traps (improvised explosive devices) can use any of the fuzes and kill mechanisms discussed above, or they may be equipped with one-of-a-kind fuzes constructed from whatever is handy at the time.

The only limit to a booby-trap's design is the imagination of the fabricator. For example, one type uses photovoltaic cells—when light of sufficient intensity strikes a sensor, the device detonates. Such a mechanism could be left in a darkened room, to initiate the next time the door is opened. Another type uses antiprobe pads; it explodes when a mine probe is pushed against it. Fortunately, soldiers rarely encounter such[16] fuzing. The vast majority of booby traps are simple affairs that have mechanical or electromechanical fuzes.[17]

Whatever the design, booby traps are best defeated by a simple technique: Soldiers must avoid handling anything left in an area recently occupied by the enemy. In particular, they must not touch items traditionally collected as "war trophies," such as enemy weapons or uniform accoutrements. Additionally, pilferable items such as food, alcohol, foreign currency, and precious metals should remain undisturbed.[18] Even a single coin, cleverly

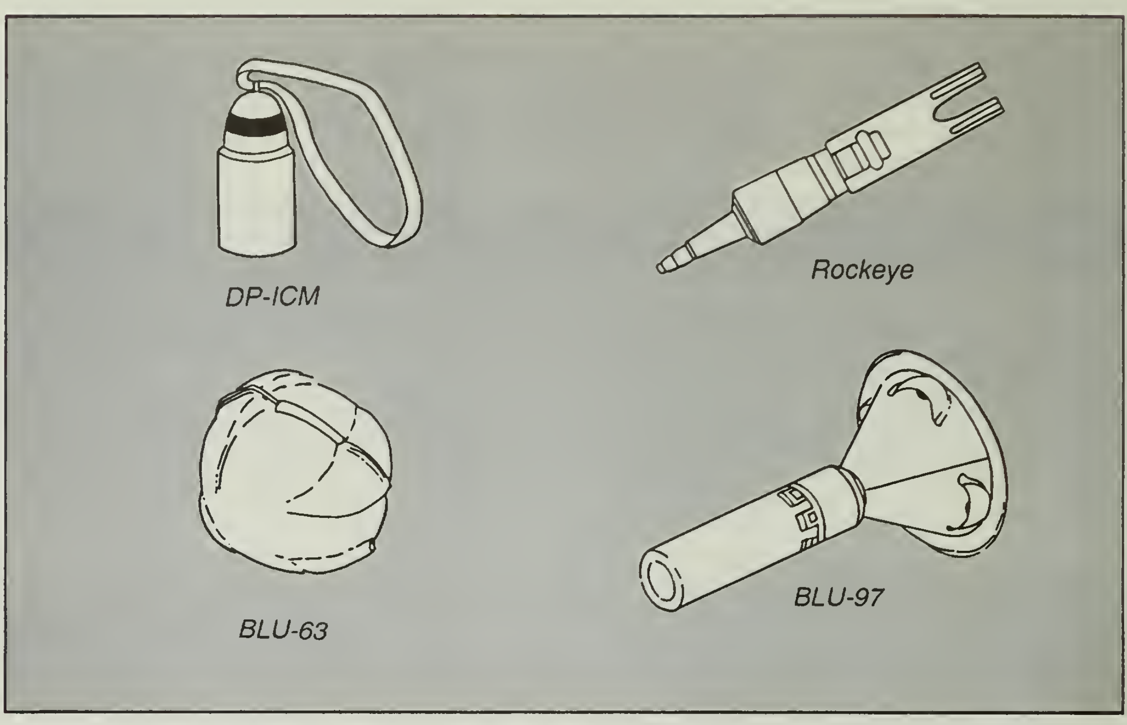


Figure 7. U.S. submunitions

connected to a hidden trip wire, can cause tragedy to personnel securing a former enemy stronghold. The lesson is clear—never handle anything found in a captured enemy position until the designated clearance team has thoroughly checked the area.

Unexploded Ordnance

Combat engineers must be prepared to counter another threat similar to a scatterable minefield. Before most ground assaults, U.S. forces subject enemy positions to intense aerial and artillery bombardment, using cluster bombs dropped from Air Force or Navy tactical aircraft and artillery-delivered, dual-purpose improved conventional munitions (DP-ICM). While U.S. submunitions (Figure 7) do not have a particularly high dud rate, so much ordnance may be thrown against enemy positions before an attack that significant quantities of unexploded bomblets may litter the objective. This problem is likely to be worse in jungles, swamps, or deep snow. Unfortunately, fire-support elements generally do not provide information to maneuver units or their supporting engineers about areas that contain these "dud minefields." This means that attacking ground units may encounter them with no advance warning.

Problems with unexploded submunitions arose both during and after Operation Desert Storm and resulted in a number of U.S. casualties. Unexploded ordnance remains a serious problem in Kuwait. Engineer units must learn from this experience and be cautious when operating in such areas. Soldiers must never pick up or handle dud submunitions, unless they are under the direct supervision of a qualified EOD technician.[19] These submunitions are often extremely sensitive: sometimes only a shake or nudge will activate the device. When practical, duds should be marked and left for clearance by EOD teams. If necessary, they may be neutralized by small-arms fire (from a safe distance) or by blowing them in place.

Countermeasures

Technical advances in AP mines impact significantly on tactical operations. In addition, U.S. countermine equipment has changed little since World War II. Under these circumstances, all combat engineers must employ some practical countermeasures. They must—

- Understand the nature and seriousness of the threat and respond accordingly. Otherwise, their ability to counter this threat will be severely limited.
- Know which breaching and detection techniques are effective against which types of mines and be prepared to improvise.[20]
- Conduct thorough advance reconnaissance of known or suspected enemy obstacle zones. Good reconnaissance can provide detailed technical information on enemy obstacles, including types of mines present and their approximate depth and density. Such information facilitates better breaching preparation.
- Remember some basic, commonsense rules (see box). Executed with good judgement, these rules can maximize performance and save lives.

Countermine DOs and DON'Ts

DO

1. Maintain proper intervals between personnel
2. Stay alert for signs of mines
3. Check wells and shaded areas before using them
4. Check doors and windows before entry
5. Maintain good battlefield police (G.I. junk makes great booby traps)
6. Control the night so the guerrilla cannot lay mines
7. Mark mines and report their location to the chain of command

DON'T

1. Use paths
2. Become predictable
3. Allow more than one man to recover a man wounded by a mine
4. Collect war trophies

Summary

Combat engineers must recognize that they are the key to solving the mine threat. If they know the capabilities of the mines used in potentially hostile countries and constantly reinforce that knowledge with realistic training, they will be able to support the mobility of U.S. maneuver forces on any battlefield.

Mr. Schneck is a civilian project engineer for the Countermine Systems Directorate, Belvoir Research, Development, and Engineering Center, Fort Belvoir. During Desert Shield/-Storm, he trained 19 U.S. engineer battalions in mine warfare techniques and Iraqi mines. He holds a bachelor's degree from the Georgia Institute of Technology.

Mr. Visser is a civilian project engineer for the Countermine Systems Directorate, Belvoir Research, Development, and Engineering Center. He previously served as an instructor in the Department of Military Engineering at the U.S. Army Engineer School. Mr. Visser is a graduate of the U.S. Military Academy, West Point.

Mr. Leigh is a special projects officer in the Countermine Systems Directorate, Belvoir Research, Development, and Engineering Center. He is a retired Army officer. Previous assignments include deputy TRADOC systems manager for mine/-countermine warfare. Mr. Leigh is a graduate of the U.S. Army Command and General Staff College and holds a bachelor's degree from Golden Gate University, San Francisco.

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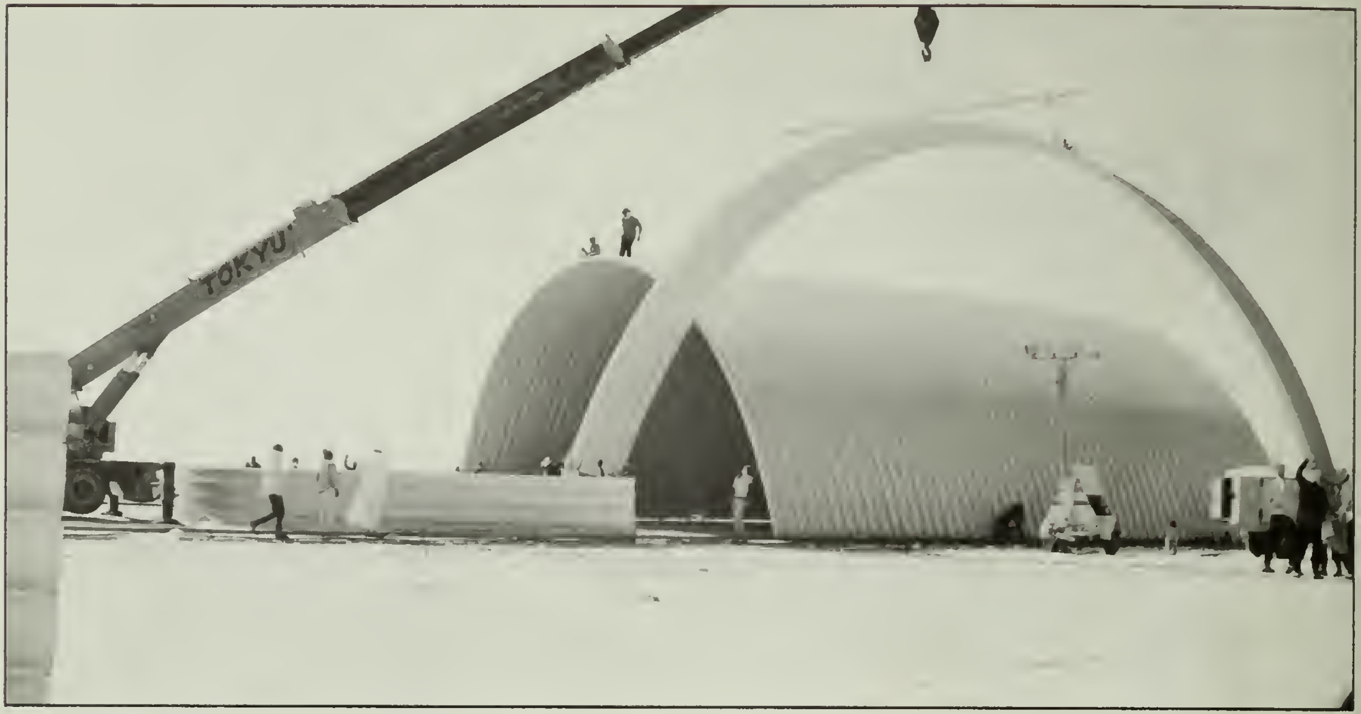


K-Spans are well suited to field construction. This K-Span is being constructed with civilian labor in Saudi Arabia.

K-Span Structures:

A Versatile Alternative for the Theater of Operations

By Captain Andrew Goetz

Self-supporting steel arch structures have had many military applications since Quonset huts were introduced in World War II. One modern iteration of this design is the "K-Span"-type building. K-Spans are versatile, easily erected, and relatively inexpensive, and they are rapidly becoming the structure of choice for many military requirements in CONUS and overseas.

K-Span construction requires a commercial, trailer-mounted, automatic building machine (ABM), coiled flat steel, and an electric seamer. Optional accessories meet a wide variety of needs. The ABMs most commonly used in military construction are the MIC-120 and MIC-240, both built by M.I.C. Industries, and the K-120 and K-240, built by K-Span, Incorporated. These ABMs are similar and parts are interchangeable. The 120s are used to build structures ranging from 30 feet wide by 12 feet high to 80 feet wide by 24 feet high. The 240s can produce "Super K-Span" structures up to 120 feet wide by 40 feet high. K-Span structures can be assembled to any desired length.

In addition to the ABM, seamers, and coiled steel, K-Span construction requires a crane to lift arch panels into place, concrete form work (available as a kit), and a welder. The skin of the building and the end walls are formed from flat steel. There are no supporting members or trusses other than door and window frames.

The ABM forms flat, continuous steel stock into straight, channelized sections of the desired length. Straight panels are curved by the trailer to form the arch. An electric seaming machine joins adjacent panels to create a strong, weatherproof joint. Once in place, the arch is self-supporting and requires no additional support except a concrete cap along the base of the panels.

K-Span structures have atributes that make them ideal or use in a theater of operaions. Available accessories inlude doors, windows, skyights, roof vents, utilities, and insulation. These accessories may be used when building aircraft hangars, motor pools, or billets. Concrete slab foundations are preferred, but any level surface can be used.

The ABM is transportable by C-130 aircraft and can be pulled by a wide assortment of military and commercial prime movers. Coiled steel is easily transported, or it can be purchased in most theaters of operation. Special-purpose accessories are usually purchased in CONUS but come well packed for overseas shipment.

K-Span construction procedures are fairly simple, and learning curves for the erection process are short. An experienced supervisor working with an untrained crew can erect a simple design in a few days. The same crew could then erect subsequent buildings even faster. Larger or more complex buildings require more construction time, and concrete slab floors must cure before use. Nevertheless, the time savings achieved is significant when compared to construction of more traditional pre-engineered buildings.

Easy to build, durable, and relatively inexpensive, K-Spans are filling a wide variety of military requirements from Fort Hood to Saudi Arabia. In a theater where engineers are in high demand, K-Span construction, supervised by experienced engineers but erected using unskilled labor, seems to fit the bill. For more information, call the Vertical Skills Division at the U.S. Army Engineer Center at DSN 676-5440 or (314) 563-5440.

Captain Goetz is chief of the Vertical Skills Division, Directorate of Training, at the Engineer School. He received an ROTC commision and a bachelor of science degree from the University of California. Previous assignments included battalion maintenance officer, company commander, and maintenance detachment commander of the 82nd Engineer Battalion and company executive officer and battalion adjutant of the 14th Combat Engineer Battalion.

Engineer Problem

You are the commander of an engineer company in a combat heavy battalion, working on a joint task force project in Honduras. Your mission is to upgrade an existing airfield for use by C-130 aircraft to support area, medium lift airfield standards.

The existing airfield, which is surfaced with aggregate, shows no significant wear from use by small aircraft. The battalion's soils specialist used a dual-mass cone pentrometer, which had been obtained from the Waterway's Experiment Station prior to deployment, to measure the strength of the runway. He determined that the airfield has a California Bearing Ratio (CBR) of 80 for the top 24 inches of soil. Other reconnaissance determined that the airfield is 2,000 feet long and 60 feet wide, and is located 2,300 feet above sea level. Surveyors informed you that the effective gradient is 2 percent. Your task is to determine the design length (takeoff ground run) of the airfield required for it to land C-130 aircraft.

Reference: Chapter 12, TM 5-330

ENGINEER Solution is on page 45.

Pre-engineered Buildings:

Quality Assurance Tricks of the Trade

By D.G. McIntosh

Pre-engineered buildings (PEBs) are multipurpose structures developed to satisfy temporary needs at stateside or forward-area locations. These structures sometimes become long-term solutions—for example, some Quonset huts erected for temporary use before, during, and just after World War II are still in use today. Because "temporary" buildings may be used 50 years or more, engineers must achieve quality construction standards that facilitate their durability over time. This article describes some tricks of the trade that will assure durable construction of these versatile structures.

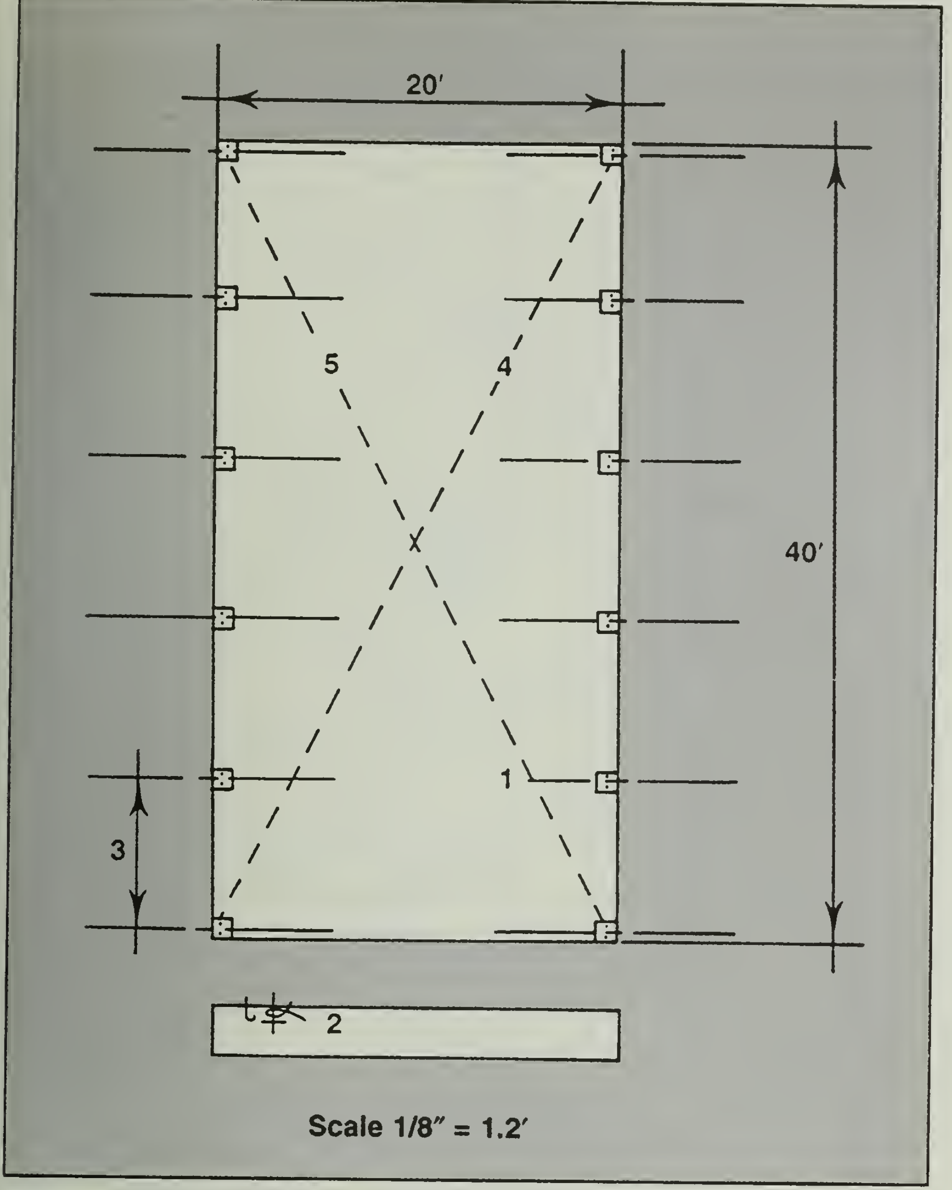
Pre-engineered buildings have many uses. This one is used to store heavy equipment and bulky supplies.

Case Study

Let's assume office space is needed. The unit has received permission to build a structure, selected a construction site, and obtained funding. A PEB purchased through the supply system is on site. It is a 20-foot by 40-foot general purpose building manufactured by any of several companies (such as Kaiser, Pascoe, Butler, or Monroe). Site clearing and underslab compaction preparation have begun, and construction will start soon. A supervisor and crew, regardless of their levels of expertise, can erect a PEB and get a high quality final product by following four quality assurance steps.

Step 1:* *Open each box containing PEB parts. PEBs come in many boxes—for example, box 1 of 19 may be bolts, and box 7 of 19 may be girts. Before construction begins, open each box, count the contents, and match them to the manufacturer-supplied inventory list. Visually check and account for each part of the PEB. This step ensures that all components required to erect a structurally sound building are on hand. It also provides time to replace any missing or defective parts.

At this point, the right soil compaction has been reached. Underground utilities are placed, tested, and stubbed up. Footers, piers, pier pads, or column pads are dug. Rebar is tied and emplaced, and forms are being put in place.



Option. Secure at least two reversible, variable-speed electric drills with screwdriver bits for use on the metal screw and rubber or neoprene washer combinations that attach the exterior "skin" to the metal frame of the PEB. Two drills will expedite the skinning out process—when only one is used, the windings often burn up from overuse. If these drills are not available, manual screwdrivers or drills without the variable-speed option may be used.

Step 2: ***Take accurate measurements.*** This step is critical to ensure proper anchor-bolt placement and a "square" structure. Take measurements after all the form work for the slab is finished and in place. The figure depicts measurements 1 through 5.

Measurement 1 is the proper distance between column anchor-bolts.

Measurement 2 is the distance across the width of the form.

Measurement 3 is the distance between anchor bolts on each side (length) of the form.

Measurements 4 and 5 are the distance between the opposite corners. These measurements must be exactly the same to guarantee that the PEB is square. This is important when skinning out a PEB because an out-of-square structure may result in misaligned roof panels or a shortage of material on one or more sides.

At this point, the slab for the PEB is poured. A 7-day cure time elapsed before the forms were stripped off. Some backfilling and grading were done around the slab. Columns are erect and secured with anchor bolts.

Step 3: ***Bolt rafters to the columns.*** This step has three parts.

- Ensure that all rafters face the same direction before bolting them to the columns. This will allow the roof fasteners to be equally spaced when the roof is attached.
- Ensure that all bolts face the same direction, have washers, and are torqued to the manufacturer's recommended foot-poundage. This ensures proper alignment and quality assurance and allows for inspection at a single glance.
- Emplace all girts and purlins before tightening the first one. Snug up girt and purlin bolts one bay at a time to minimize the chance of misaligning the structure. (Bays are the distance between any two columns on the same side.)

Erection of the PEB is now nearly complete. All columns, rafters, girts, purlins, braces, and kickplates are in place and properly and securely bolted together. Door and window openings are installed. The frame is solid and has been inspected and approved by the resident officer-in-charge of construction or the activity civil engineer.

Step 4: ***Skinning out the PEB.*** This three-part step will assure a watertight structure and a quality final product.

- Attach the first piece of "skin" or metal sheeting that forms the exterior of the PEB. Proper alignment of the first sheet is critical because it dictates the alignment of those that follow. When the first sheet is properly aligned, secure it with an electric drill and sheetmetal screws. Each screw must have a rubber or neoprene washer to ensure the PEB is weather-tight.

- Form metal joints by overlapping each sheet on the previously placed sheet. Adjust the overlap to lengthen or shorten the joints, but use this technique only when necessary—for example, it may be needed around doors or windows.
- Caulk the edge of all sheeting to ensure watertight joints. Most PEB manufacturers require a sealant between the overlap joints, but the gum-backed sponge-rubber sealant provided by the manufacturer may have exceeded its shelf-life by the time the PEB is constructed. To form a proper seal, obtain several tubes of white, clear, or black caulk, preferably the nonhardening type.

Summary

Any erection crew can use these quality assurance steps as tricks of the trade to construct a PEB that will retain strength and durability throughout its serviceable life. Following these steps will extend the life and durability of any pre-engineered building and allow the user to successfully accomplish the mission.

Mr. McIntosh, a building code inspector in Pensacola, is a retired chief utilitiesman from the U.S. Navy. While serving in the Seabees, he deployed with several construction battalions, served as an instructor, and served as an operations chief for a construction battalion unit.

(Personal Viewpoint, continued)

focus on your weaknesses and you will lose. Use your engineer assets, unit equipment, and talents—it's called "leveraging"—and use them to support others. Having said that, you must excel in soldier basics and small-unit tactics. Compete to standards; be your own competition, using your uniqueness and the rater's priorities. Set the standards of excellence, compete against those standards, and win.

- ***Talk, live, and breathe operations orders and FRAGOs.*** Don't be a part-time soldier, saving operations orders only for the field. The mindset must be a battle-focused one, and you get that only by practicing it all of the time.Make sure there are six paragraphs with the additional one being "safety." Be toe-to-toe with all other units when it comes to soldier skills, a warrior spirit, and safety. As part of this battle focus, keep your units on the cutting edge by having part of your command, at almost any time, in the field. Be the first in line for Joint Readiness Training Center and National Training Center support, even if it's only to send one platoon. Take those rotations and combined arms training over long-term engineer deployments. Don't extend beyond the interests of the division.
- ***Get yourself, the unit leaders, and the soldiers involved with the community.*** Sponsor a school; offer to assist with the rear detachments of deployed units; support a boy scout troop, Army Emergency Relief, Association of the U.S. Army, the division association, or whatever else is out there requesting help. In essence, belly up to the community bar before you are asked to by the command. Spot the post challenges and become the solution. Make it happen. And as you do it, advertise the unit but never yourself. You're not the center, your soldiers are.
- ***FORSCOM is number 2; the division, even though you don't wear the patch, is number 1.*** The division staff knows who FORSCOM is and what units belong to it; you don't have to remind them nor should you try to play one against the other. In USR and other capabilities briefings, focus on what you can do for the division not what you can't do or what the division must do for you. No one likes a moaner so keep a positive attitude and face the distant guns.

Choose Your Strategy

The choice really is yours. You can groan and take everyone to task or you can use your strengths to make your soldiers invaluable to the division. The "Charles Atlas position" on the OER is not where you have to be. Know your boss and line up your priorities. You will find that you can do your own thing and enjoy it, to boot.

Wisdom is the combination of experience and vision. I have stated my two cents worth of experience and vision. Do you have the wisdom to properly apply it? Choose your block.

Colonel Harback is commander of the Louisville District, Army Corps of Engineers. Previous assignments include commander, 14th Combat Engineer Battalion; and XO, Bayonet Combat Support Brigade, 7th Infantry Division. He has masters degrees from Northern Illinois University and Long Island University and is a graduate of the Command and General Staff College and the Army War College.

FY 94 SDTs Affect NCO Careers

By Jim Evans

Scores from FY 94 self-development tests (SDTs) will be a key factor in determining promotions, assignments, school selections, and retention for Active Component noncommissioned officers (NCOs). (SDT scores will not affect Reserve Component NCOs until FY 95.) Whether you are a unit commander or an NCO, the following recommendations can help with the SDT preparation process.

Commanders

Although you are not required to provide unit training for SDT testing, you have a vested interest in ensuring that your talented people do well on these tests. This support requires only a minimum investment of unit resources:

- ☐ Ensure that each NCO has a personal copy of FMs 22-100, 22-101, 22-102, and 25-101. These are basic references for the training and leadership portions of SDTs.
- ☐ Ensure that the local learning center has all references listed in each NCO's STPs and SDT notices. Don't overlook low-strength MOSs.
- ☐ Delay testing until near the end of the three-month test window if some references for an MOS are not available in the learning center when the window opens.
- ☐ Encourage your NCOs to share references and strengths by forming study groups. Many soldiers have sizable personal reference collections; all have knowledge to share.
- ☐ Coordinate with other units so that NCOs can become familiar with equipment not available in their unit.
- ☐ Avoid scheduling NCOs for overnight duty the evening before testing. SDT scores are potentially as important to NCOs as college entrance exams were to you.

Note that four of these six recommendations pertain o references. To make their best scores, NCOs must tudy the appropriate references. The role of learning enters in providing references for all NCOs they suport cannot be overemphasized. Support your soldiers if hey encounter problems at the learning center.

NCOs

FY 94 SDT scores (unlike the scores from the past two years) will significantly affect future opportunities in the Army. To get the best score possible,—

- ☐ Ensure that the local learning center has or acquires all references listed in your STP.
- ☐ Notify the local TSO or your supervisor if you do not receive an SDT notice approximately two months before the test window opens.
- ☐ Take your notice to the local learning center as soon as you receive it, and request any required publications not on hand. Refer problems encountered at the learning center to your chain of command.
- ☐ Begin preparing for the SDT immediately after receiving the notice.
- ☐ Understand the reference portion of the SDT notice. The references used to prepare the questions for any given task are noted by letters in the right-hand column and listed at the end of the skill level portion of the notice. Study only those paragraphs or pages that relate to a particular task.
- ☐ Request time to become familiar with pertinent equipment in nearby units if they have some your unit lacks.
- ☐ Form a study group with NCOs in your MOS to prepare for the technical portion of the SDT, and study with NCOs of your rank to prepare for the leadership and training portions.
- ☐ Know how to use the calculator you will take to the test site if one is prescribed in the notice. To be safe, take an extra set of batteries.
- ☐ Get a good night's rest before the test.
- ☐ If you are nervous at the test site, try alternately tensing and relaxing your muscles. This simple exercise can help tremendously.

Remember, to prepare for this important test, seize the initiative early. Ensure that all references are available. Seek others who share your MOS and skill level, and study with them. The Army values initiative; the SDT requires and rewards it!

Mr. Evans is the product manager for SDTs at the Engineer School.

Mapping Your Career the Engineer Way

By Master Sergeant Jose Bonilla, Master Sergeant Kathryn Kindle, and Sergeant First Class Benjamin Twigg

Making a career as an enlisted soldier is not a quick or easy decision for anyone. Once you've made the decision, planning how to accomplish your goal is the next step. The following sample engineer career maps provide the guidance needed to stay competitive in three career management fields: Combat Engineers (CMF 12), General Engineers (CMF 51), and Topographic Engineers (CMF 81). Additional information is in AR 611-201 and DA Pam 600-25. Use your NCO support channel to get your career plan on track.

MSG Bonilla, MSG Kindle, and SFC Twigg are proponent coordinators with the Engineer Personnel Proponency Office, at Fort Leonard Wood.

CMF 12 Career Professional Development Program

Civilian schools	High school, GED diploma	College * 1 year		2 years	3 years	
Other schools		Drill Sergeant School →| Recruiting School	Battle Staff Course →|		1SG Course →|	
NCOES	PLDC →|	'BNCOC →|	ANCOC →|		USASMA →|	
Encouraged assignments		Recruiter, Retention →| Drill sergeant	Instructor →|	Operations / Intelligence sergeant →	Reserve Component advisor CMF 12 staff assignments →	CSM
Key leadership assignments	Crewmember Veh operator Cbt engineer	Team ldr Crew chief AVLB cdr	Sqd ldr Sec ldr CEV cdr	Plt/sec sgt Det sgt Team sgt	1SG	CSM
Rank	PVT, PFC SPC, CPL	SGT	SSG	SFC	1SG MSG	SGM CSM
Years of service	1 - 3	4 - 6	7 - 9	10 - 15	16-19	20-30

* A goal; understand that troop assignments often preclude off-duty education

CMF 51 Career Professional Development Program

Civilian schools	High School, GED Diploma	College * 1 year		2 years	3 years	
Other schools		Drill Sergeant School →| Recruiting School	Battle Staff Course →|	1SG Course →|		
NCOES	PLDC →|	BNCOC →| ANCOC →|			USASMA →|	
Encouraged assignments		Recruiter, Retention Drill sergeant →|	Instructor →| Operations/Intelligence sergeant →	Reserve Component advisor CMF 51 Staff assignments →| Construction sergeant Inspector / Foreman →		CSM
Key leadership assignments	Equip operator Const specialist Gen engineer	Team ldr Sr equip opr	Sqd ldr Const sup Sec ldr	Plt/Sec sgt	1SG	CSM
Rank	PVT, PFC SPC, CPL	SGT	SSG	SFC	1SG MSG	SGM CSM
Years of service	1 - 3	4 - 6	7 - 9	10 - 15	16-19	20-30

* A goal; understand that troop assignments often preclude off-duty education

CMF 81 Career Professional Development Program

Civilian schools	High school GED diploma	College * 1 year		2 years	3 years	
Other schools		Drill Sergeant School →| Recruiting School	Battle Staff Course →|	1SG Course →|		
NCOES	PLDC →|	BNCOC →| ANCOC →|			USASMA →|	
Encouraged assignments		Recruiter, Retention Drill sergeant →|	Instructor →| Operations sergeant →	Reserve Component advisor CMF 81 staff assignments →| Senior topographer Intelligence sergeant →		CSM
Key leadership assignments	Equip operator Inst repairer	Team ldr Sect sgt	Sqd ldr Sec ldr Proj NCO	Plt/Sec sgt Det NCOIC	1SG	CSM
Rank	PVT, PFC SPC, CPL	SGT	SSG	SFC	1SG MSG	SGM CSM
Years of service	1 - 3	4 - 6	7 - 9	10 - 15	16-19	20-30

* A goal; understand that troop assignments often preclude off-duty education

Lessons Learned

The Role Of The Engineer Liaison Officer

This article describes the duties and functions of an engineer liaison officer (LO). U.S. Army engineer units performed critical roles in such joint and combined operations as Operations Desert Shield/Storm, Provide Comfort and Restore Hope, and Joint Task Forces Andrews and Iniki. One key to the success of those operations was the ability of engineer LOs to coordinate and complete multiple missions with diverse maneuver and engineer units. The LO's primary role is to teach and advise the gaining headquarters on his unit's assets and capabilities.

Some engineer LOs, however, do not understand their duties or lack adequate support to accomplish them. Because the world situation is unstable, the Army will continue to participate in combat operations and operations other than war, such as humanitarian assistance and disaster relief missions, which require effective engineer liaison support. The following information will help future engineer LOs perform their missions successfully. For more information write to Commandant, U.S. Army Engineer School, ATTN: ATSE-ESA-L, Fort Leonard Wood, MO. 65473-6630. Or call (314)-563-5302, DSN 676-5302.

Issue: Some engineer LOs provided inadequate liaison support during recent combat operations and operations other than war.

Discussion: During Desert Storm, U.S. Army engineer LOs assigned to the French and British armies lacked adequate support, including communications equipment and vehicles. As a result, their ability to perform duties and provide timely and effective coordination was severely degraded. How many times have you been in an engineer tactical operations center (TOC) and heard either the S3 or the commander state that the unit needed to send a liaison officer to brigade, division, or another unit? Usually in those situations, there is some debate about who to send to best meet the requirement.

Commanders face two issues when tasked with sending an engineer LO to another headquarters. First, they must resource the requirement from already scarce personnel resources. Thus, some commanders may choose to send a newly assigned or inexperienced officer who has limited tactical experience, no knowledge of the unit's standing operating procedures (SOPs), is unfamiliar with the staff, and does not know how the unit normally functions in deployment or during an exercise. Secondly, they must provide physical support requirements, such as vehicles, communications equipment, and additional enlisted personnel. Although these requirements may be scarce, the parent unit must provide them. Insufficient support can quickly lead to frustration or complacency on the LO's part and result in the unit's failure to receive crucial and timely information.

Recommendations:

Supporting (Parent) Engineer Commander's Decision Criteria

The LO represents his commander at the headquarters of another unit and coordinates and promotes cooperation between them. A commander should assign LO duties to someone dedicated full time to that position, not make it an additional duty. An engineer commander who sends a poorly qualified or poorly equipped LO hurts himself and his unit, and makes a poor impression on the headquarters to which the LO is assigned. When selecting an engineer LO, the commander must ensure that the candidate has the following qualifications:

- Rank and experience appropriate for the headquarters to which he is assigned. The LO should possess tactical engineer skills in areas such as battlefield assessments, breach and obstacle planning, etc.
- Ability to communicate effectively both orally and in writing. It is especially critical that the LO possess strong staff briefing skills.
- Detailed knowledge of the parent unit's SOP and operation plans and orders (OPLANs and OPORDERS).
- Knowledge of the coalition force's language, when working with an allied unit. If knowledge of a foreign language is required but not available, the parent unit ensures an interpreter is provided.
- Attributes such as a proper uniform and sharp personal appearance enhance effective liaison activities.

Parent Engineer Unit Responsibilities

After an LO is selected, the parent unit headquarters provides appropriate briefings and support:

- The G3/S3 or his duty officer thoroughly briefs the LO about the current situation in the unit and the commander's intent, including details of the concept of operations. This briefing includes unit locations, front line trace, engineer planning factors, combat readiness factors such as personnel strength and logistic considerations, and a map with overlays.
- The G3/S3 briefs the LO about the current status and missions of the assigned unit. After this briefing, each staff section informs the LO about their specific liaison and information requirements. For example, the S2 may require detailed terrain information. These briefings ensure that the LO clearly understands his mission and responsibilities.

Engineer Liaison Officer Responsibilities

To perform successfully, an engineer LO must complete the following tasks:

- The LO places all acquired information in a battle book, which he can carry easily and use to file information needed or obtained at the duty site. The LO uses the battle book when conducting briefings.
- The LO ensures that arrangements for communications and transportation meet mission requirements. He checks assigned radios, signal operating instructions (SOI), challenge and passwords, and ensures rations are provided. The LO obtains required specialized equipment, security clearances, and credentials for identification into the higher headquarters' TOC.
- If conducting liaison with coalition units, the LO ensures that language or interpreter requirements are met.
- After arriving at the assigned unit, the LO reports to the commander or his representative (G3/S3 or chief of staff) and is prepared to brief the parent unit's situation. He visits each staff section, provides information requested, and obtains information needed by the parent engineer unit.
- Because the LO provides a vital link to the parent unit, he continually advises the TOC duty officer, the secretary of the general staff, or chief of staff of his whereabouts.
- Throughout the tour, the LO keeps informed of the situation at the parent unit and makes that information available to the commander and staff of the assigned unit. He accomplishes this task without interfering with operations at the assigned unit. He keeps an accurate record of all communications in a staff journal. He reports on those matters within the scope of the mission and informs the assigned commander of information sent to the parent unit.
- A major LO function is to promote harmonious relations between the parent engineer unit and the assigned unit. As the parent unit's representative, the LO's actions significantly affect the higher headquarter's perception of his unit's engineer support.
- The LO immediately informs the parent unit any time he is unable to perform his responsibilities at the assigned unit.
- After completing his mission, the LO presents an out-brief to the commander or G3/S3.
- Upon return to the parent unit, the LO briefs the engineer commander or his representative regarding all information received during the visit. This includes detailed information concerning the higher headquarter's mission, unit locations, future operations, commander's intent, mission requirements and requests for information. The LO clearly and accurately briefs all staff sections regarding detailed information received during the visit, and transmits information required by higher headquarters to each staff area of responsibility.
- The LO keeps abreast of the current situation and stays prepared to respond to future liaison requirements.

Assigned Unit Responsibilities

After the engineer LO arrives at the duty site, the assigned unit provides the following briefs and support:

- The staff briefs the LO about their current operations. They provide the LO with rations, fuel, maintenance (if possible), communications equipment, and work and sleep areas.
- Like the LO, the assigned unit's staff fosters and promotes harmonious working relationships.

Liaison officers resolve issues and problems between headquarters. The responsibilities described in this article and on the next page will help engineer LOs perform their duties successfully and promote mutual understanding and unity of action between parent and assigned units.

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Engineer Liaison Officer Checklist

Engineer Commander Responsibilities

For a liaison mission to be successful, the commander of the parent unit ensures that the LO—

- ☐ Has the rank and experience appropriate for the assigned headquarters.
- ☐ Is experienced and knowledgeable about tactical operations, engineer battlefield assessments, engineer planning factors, combined arms breaching/obstacle operations, and construction operations.
- ☐ Can communicate well both orally and in writing, and has superior briefing skills.
- ☐ Has a working knowledge of a common foreign language or access to an interpreter if working with a coalition unit.

Liaison Officer Responsibilities

After notification of the liaison assignment, the LO—

- ☐ Hands over his previous duties to a replacement or the person assuming his responsibilities.
- ☐ Is briefed by the commander or his representative on the unit's present situation and future operations.
- ☐ Develops a battle book, which contains as a minimum:
  - Parent unit's operations orders, plans, and overlays
  - Parent unit's tactical SOP
  - Commander's intent for the present operation
  - Planned operations
  - Engineer planning factors
  - Personnel and logistics combat readiness factors
- ☐ Obtains each staff section's requirements and/or required reports.
- ☐ Obtains proper security clearances and credentials from the G2/S2.
- ☐ Obtains signal operating instructions (SOI) and challenge and passwords from the communications officer.
- ☐ Obtains communications equipment.
- ☐ Checks out communications equipment and coordinates with communications officer for replacement equipment.
- ☐ Obtains vehicle support.
- ☐ Coordinates for maintenance and Class III fuel support.
- ☐ Conducts vehicle safety check.
- ☐ Obtains Class I rations support or coordinates for its issue.
- ☐ Obtains required specialized equipment.

Upon arrival at the assigned unit and throughout the tour of duty, the LO—

- ☐ Briefs the commander or his representative on the status of the parent unit, using the battle book.
- ☐ Meets and coordinates with primary staff members.
- ☐ Identifies work and sleep areas.
- ☐ Establishes and maintains communications with the parent unit.
- ☐ Coordinates for Class I, III, and maintenance support.
- ☐ Maintains a staff journal.
- ☐ Submits reports as required.
- ☐ Conducts briefings as required.
- ☐ Develops and maintains harmonious relationships with the assigned unit.

Before returning to the parent unit, the LO—

- ☐ Out-briefs the commander or his representative.
- ☐ Updates and completes all reports, the staff journal, and the battle book.
- ☐ Conducts a final briefing with all staff sections.

After returning to the parent unit, the LO—

- ☐ Briefs the commander or his representative on the tour of duty, including the supported unit's present and future operations, and presents updated reports and overlays to the parent headquarters.
- ☐ Submits the battle book to the G3/S3 duty officer.
- ☐ Visits and updates all staff sections.
- ☐ Turns in assigned vehicles, equipment, security items, etc.

Assigned Unit Responsibilities

The assigned unit provides the LO with—

- ☐ In-brief concerning unit operations and missions.
- ☐ Information required by the parent unit, including daily briefings, maps, reports, etc.
- ☐ Work and sleep areas.
- ☐ Common logistical support, including rations, water, fuel, ammunition, and maintenance support.
- ☐ Access to communications systems.

Engineer Solution

A determination of the runway length required for any aircraft includes the surface actually needed for landing rolls or takeoff runs, plus reasonable allowances for variations in pilot technique, psychological factors, wind, snow, other surface conditions, and unforeseen mechanical failures. The runway length is determined by applying a safety factor to the takeoff ground run (TGR) established for the geographic and climatic conditions at the installation. The process to compute the runway length follows:

Step I. Determine takeoff ground run. Using Table 12-3, you determine that the TGR for C-130 aircraft in a support area is 2,800 feet at sea level for an average maximum temperature of 59°F.

Step 2. Determine pressure altitude correction. To determine the correct pressure altitude for Honduras, add the height of the elevation differential (dH value) for the site to the geographic altitude. Then increase the TGR by +10 percent for each 1,000 feet in altitude above 1,000 feet. Using Figure 12-5, you determine the dH value is 200 feet. Complete the following equation to calculate the correction:

$$(2{,}300 + 200 \text{ feet} - 1{,}000 \text{ feet}) \times \frac{10 \text{ percent}}{1{,}000 \text{ feet}} = 15 \text{ percent or}$$

$$1.15 \times 2{,}800 \text{ feet} = 3{,}220 \text{ feet}$$

Step 3. Determine temperature correction. For runways with a TGR less than 5,000 feet, increase the pressure correction length by +4 percent for each 1°F increase in temperature above 59°F. The average maximum temperature for Honduras (from Figure 12-6) is 90°F. (When in between isopleth values, use the higher value.) The calculation to determine the temperature correction is:

$$90^\circ - 59^\circ \times \frac{4 \text{ percent}}{10^\circ} = 12.4 \text{ percent or } 1.124 \times 3{,}220 \text{ feet} = 3{,}619 \text{ feet}$$

Step 4. Incorporate safety factor. Add a correction factor for safety. For support area airfields the factor is 1.25.

$$1.25 \times 3{,}619 \text{ feet} = 4{,}524 \text{ feet}$$

Step 5. Determine effective gradient correction. Increase the effective gradient by +8 percent for each 1 percent of effective gradient over 2 percent. Because the gradient at this airfield is 2 percent, no correction is necessary.

Step 6. Round up. Next, round up the TGR that is corrected for pressure altitude, temperature, and safety factor to the next higher 100 feet:

4,524 feet = 4,600 feet

Step 7. Compare the calculated length with the minimum required. Finally, compare the calculated length obtained in step 6 with the minimum required, as shown in column 5 of Table 12-4 (foldout in back of TM 5-330). Table 12-4 shows a required length of 3,500 feet. Congratulations if you calculated and selected 4,600 feet as the appropriate length for the upgrade.

This ENGINEER Problem/Solution was submitted by Captain Mark S. Kuehl, Chief, Horizontal Skills Division, Directorate of Training, U.S. Army Engineer School.

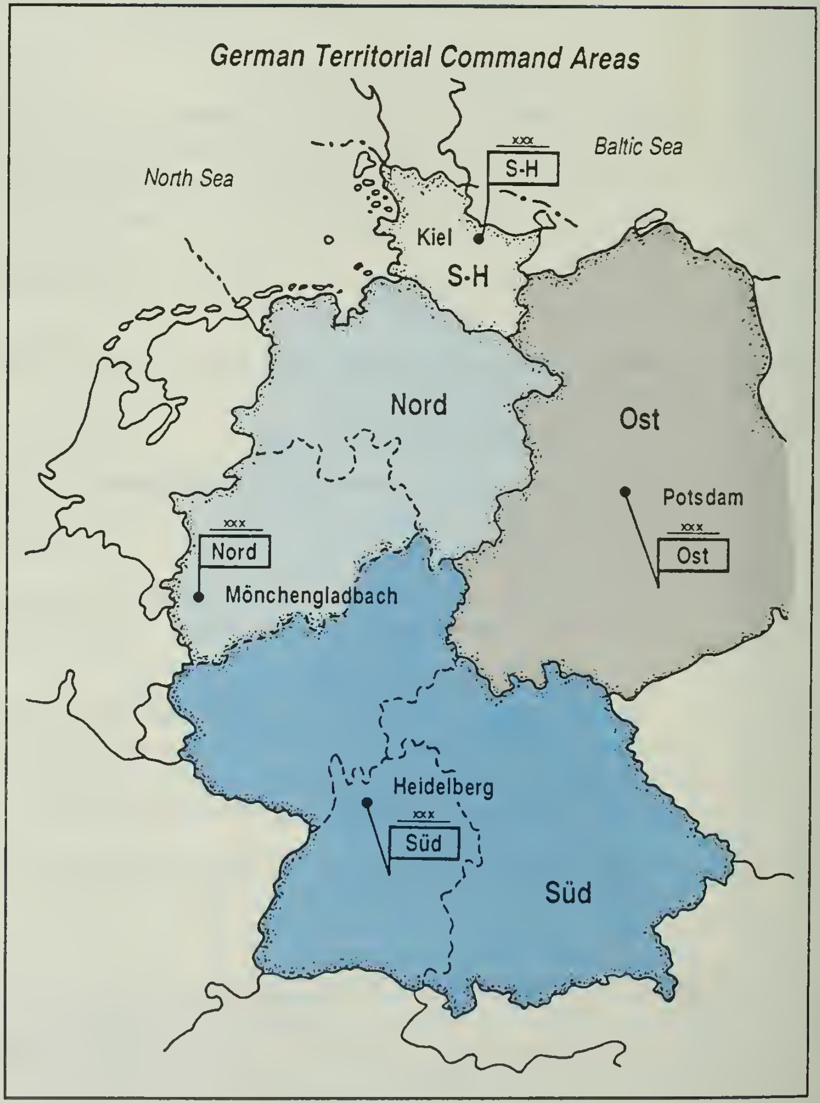
Germany's Military Role in a New World Order

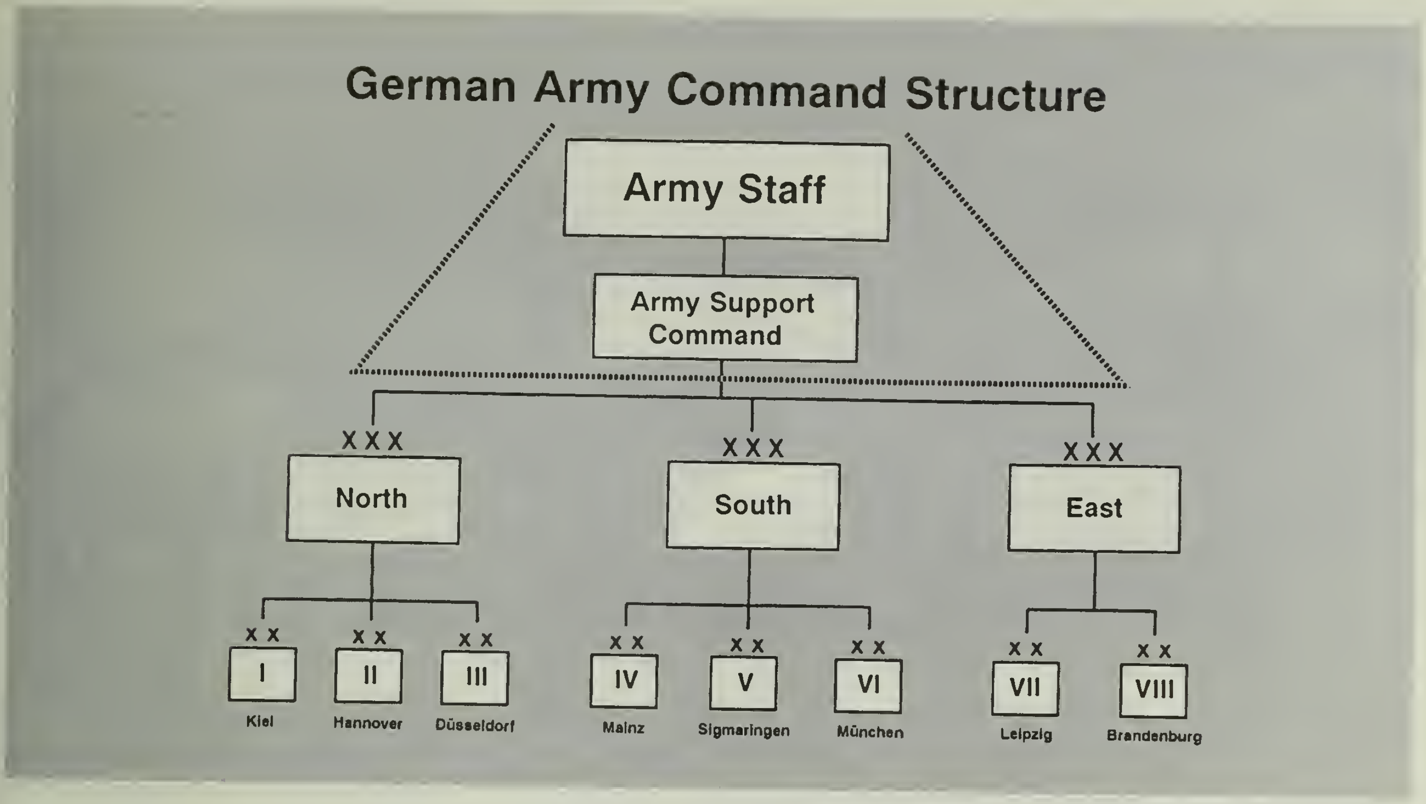
By Lieutenant Colonel Reinhold Hocke and Second Lieutenant N. Dan Nelson

The east and west republics of Germany, divided since 1949, reunited on October 3, 1990. Since that time, the German Army (Bundeswehr) has been redefining its military mission within a larger German border and an unstable eastern Europe. While remaining a loyal and committed member of the North Atlantic Treaty Organization (NATO), the political and economic agendas Germany faces today have led it to look beyond the static General Defensive Plan (GDP) mission. The GDP-oriented military training used during most of the Cold War is being revamped to include more flexible, mission-oriented postures that are better suited to the changing world environment. The shift away from a sole main defensive force will result in additional airmobile units, in-place crisis reaction forces, and basic military organizational elements.

Facing The Challenge

Since 1990, the Bundeswehr has been responsible for all ground forces in Germany,





> “Countermobility, mobility, and survivability will remain the principal missions of the engineers.”

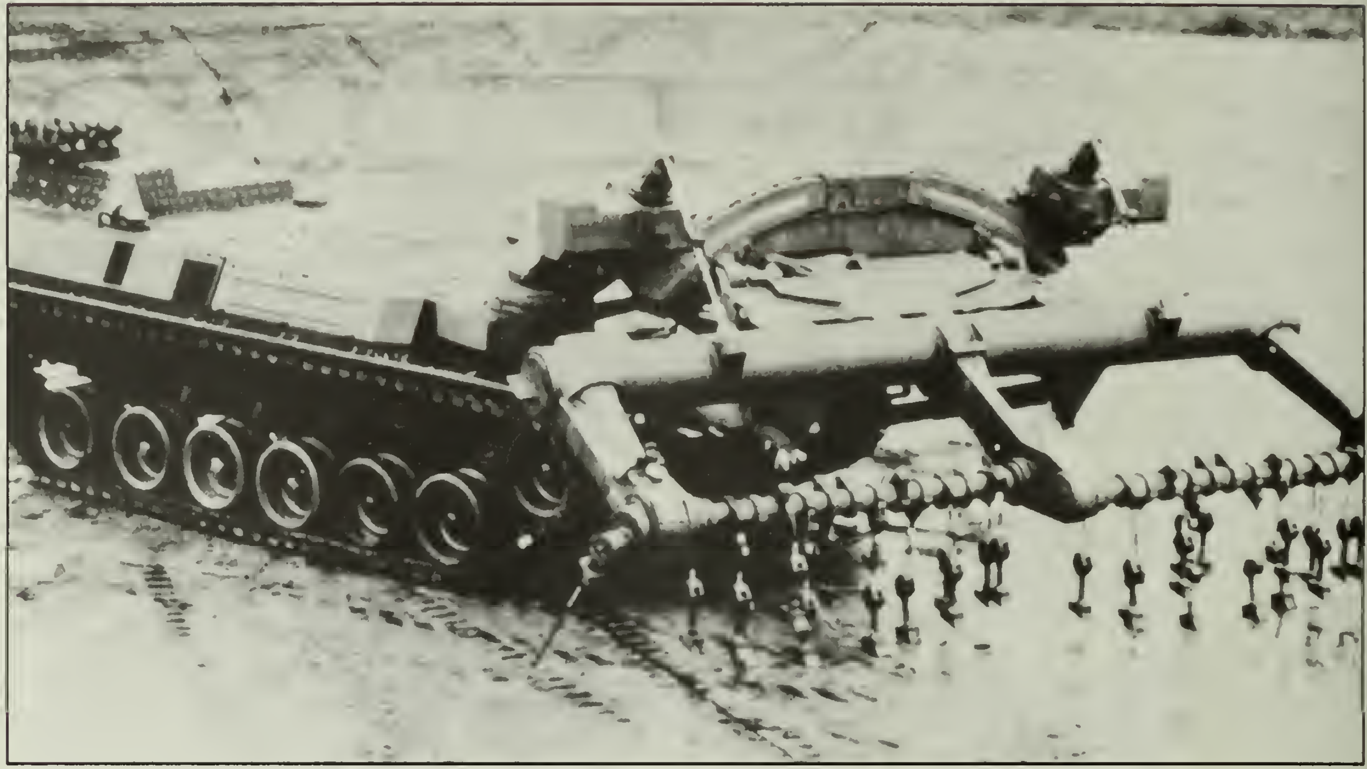
including those that were part of the German Democratic Republic (GDR) People’s Army before 1990. Germany has successfully integrated those troops into its defensive network and thus into the overall NATO alliance. Soviet-made equipment once used by the GDR is being destroyed, stockpiled, or sold to third parties on a restricted basis—for example, some bridging equipment is being sold to Finland. The current Bundeswehr can use only a limited amount of this equipment because most of it does not meet West German safety and environmental standards.

Germany is actively developing a Franco-German Corps. This multinational military structure may be a prelude to a unified multilateral European community force that would work under the auspices of the Western European Union (WEU). To facilitate this movement, Germany and France are working to resolve technical issues such as weapons, communications compatibility, and common rules of training and engagement. Once operational, the corps’ mission would be to “preserve and restore the peace.” This force may be willing to deal with intricate problems such as the current situation in the former Republic of Yugoslavia. While Germany has provided relief supplies and humanitarian aid to Yugoslavia, it has not been involved militarily in this conflict for historical reasons and because of Basic Law parameters.

The German Basic Law, or Grundgesetz (Constitution) was drafted after World War II to ensure that Germany could not establish a strong offensive force. Article 87a of the Grundgesetz prohibits Germany from committing forces to such military actions as Operations Desert Shield and Desert Storm. Thus, Germany has not deployed forces outside the NATO area since 1950.

Criticism concerning Germany’s lack of combat involvement in Operation Desert Storm led to a political movement in the Bundestag (parliament) to amend Article 87a. This amendment would broaden the range of permissible missions, allowing the Bundeswehr to participate in military actions. Until such an amendment is approved, however, Germany is limited to providing nonmilitary personnel for humanitarian assistance in crisis-torn areas (not combat zones).

The Bundeswehr’s newly defined mission statement includes several modified or new missions that will help Germany deal with problems it could not address before reunification. The mission



The Keiler mine-clearing tank

statement directs Germany to—

- Protect German territorial integrity and citizens against outside threats.
- Fulfill commitments to the NATO alliance.
- Maintain strong, lasting military cooperation with allied nations and all European partners in order to facilitate political stability in Europe through military stability.
- Be prepared to assist in UN missions defined by Chapter VII of the UN charter.
- Be prepared to assist in disaster relief and environmental protection missions.

Restructuring

In spite of these developments, Germany is expected to decrease its active forces from the current 450,000 to 370,000 by 1995. This reduction will be accomplished through generous early retirement programs and decreased recruitment of personnel strength levels. No change is expected in the conscription laws that require all able-bodied males to serve in the military for a minimum of 12 months.

The restructured Bundeswehr will consist of three corps: North, South, and East. Of the 370,000 troops, 257,800 will be Army; 83,200 will be Air Force; and 29,000 will be Navy. The Pioniere (Corps of Engineers) will constitute roughly 7 percent, or 17,850 troops.

Engineer units will be concentrated at two levels. Independent engineer companies will support maneuver brigades; other engineer assets will combine to form engineer brigades that operate at the division or military district command levels. Each brigade will consist of one active and one reserve combat engineer battalion, one active and one reserve bridging battalion, and one active and one reserve NBC battalion.

Countermobility, mobility, and survivability will remain the principal missions of the engineers. Minefield emplacement, minefield breaching, and river and gap crossing operations will continue to be the most important tasks. General engineering, however, will be broadened to encompass survivability, disaster relief, environmental protection, and nature preservation missions. Airmobile operations will gain in importance and will include the continued development of air-transportable bridging equipment, folding trackway, engineer construction equipment, and modern mine-delivery systems.

Despite a smaller force and continued defense cuts, Bundeswehr engineers will be equipped with the modern tools needed to successfully complete missions. These tools include mineclearing, bridging, and mobility equipment.

Mine-clearing equipment. The Keiler is the most modern mine-clearing tank in the German inventory. Consisting of a two-man crew carrier vehicle and the

Dornier Foldable Bridge

clearing device, the Keiler can remove all currently known types of mines, including surface-laid and buried mines and those equipped with high-tech fuzes. It is very effective in breaching minefields. Using flails on a rotating drum, the Keiler can create a lane 4.7 meters wide and 0.25 meter deep. The revolving elements fling mines sideways out of the vehicle's path. The device is highly resistant to wear, and flails can be replaced when damaged.

Bridging equipment. State-of-the-art bridging equipment will be integral to the newly restructured engineer brigades. The M3 amphibious, fast-floating bridge system will be procured from Great Britain beginning in 1995. The M3 can construct a bridge up to 100 meters long, carry vehicles up to military load class (MLC) 70, and operate in currents up to 3.5 meters per second. The Dornier Foldable Bridge, a heavy assault bridge with a maximum span of 40 meters, can carry an MLC 70. Five men can construct the bridge in one hour.

Mobility equipment. The folding trackway (Faltstrassengeraet) and the Badger Engineer Tank II (Pionierpanzer II Dachs) will substantially improve mobility operations in the restructured engineer brigades. The Faltstrassengeraet rapidly provides trafficability on poor terrain, and the Pionierpanzer II Dachs is used to prepare river accesses and exits.

Looking Forward

While the U.S. government is reducing its force structure and closing several bases overseas, there is no plan yet to reduce U.S. forces below the 65,000 proposed for Europe. German politicians do not want a radical reduction in U.S. troop strength below that already planned in Germany. While base closures cause unemployment in affected German communities, the primary reason for a continued U.S. presence is the desire to preserve the NATO alliance.

The friendship that exists between the U.S. and Germany must continue. For more than 40 years, U.S. Army and Bundeswehr troops have trained side by side, fostering friendships and exchanges on individual and unit levels. Programs such as sporting events, school exchanges, and German-American clubs promote open communication and understanding.

The Bundeswehr is restructuring its current force to meet future challenges. The diverse events shaping European history today will define the future German force structure and ultimately affect the shape of the NATO force and the U.S. presence in Europe.

Lieutenant Colonel Hocke serves as German Foreign liaison officer to the U.S. Army Engineer School and Center, Fort Leonard Wood, Missouri. He previously served as commander of the German 61st Engineer Battalion, 6th Armored Infantry Division. Other assignments include staff officer engineer and senior combat engineer officer, Headquarters Allied Forces Central Europe, and executive officer for the 850th Pipeline Engineer Battalion in Zweibruecken. He is a graduate of the German General Staff Officers Course at the Federal Armed Forces Command and General Staff College, in Hamburg.

Second Lieutenant Nelson currently serves as a close combat platoon leader with the 2nd Infantry Division, Korea. He is a graduate of EOBC, airborne, and air assault schools. He holds a bachelor of science degree from the University of Florida and has recently returned from a year in Germany as a Federal Chancellor Scholar.

Terrain Intelligence and Battlefield Success:

A Historical Perspective

By Major William J. Bayles

Today, as in the past, terrain intelligence and obstacle data are critical to the success of any maneuver commander. Army professional journals frequently print graphic descriptions of National Training Center battles in which attackers are disrupted and subsequently destroyed in minefields that they failed to locate—until too late. During World War II, commanders learned many such lessons, at greater cost. This article describes successful and unsuccessful missions that illustrate the relationship of terrain intelligence to battlefield success.

The Second Battle of Schmidt

The Second Battle of Schmidt demonstrates a costly failure of terrain intelligence. On November 2, 1944, the 28th Infantry Division launched an attack toward Schmidt, Germany, to seize its road junction and gain maneuver space and additional supply routes for future operations. The attack drove the Allies closer to one of several large and operationally important dams on the Roer River.[1] The plan of attack called for elements of the 112th Infantry Regiment to secure the village of Schmidt, with supporting armored forces following to blunt the edge of any German armored counterattacks. Thus, the division's success depended on getting armored vehicles to Schmidt.

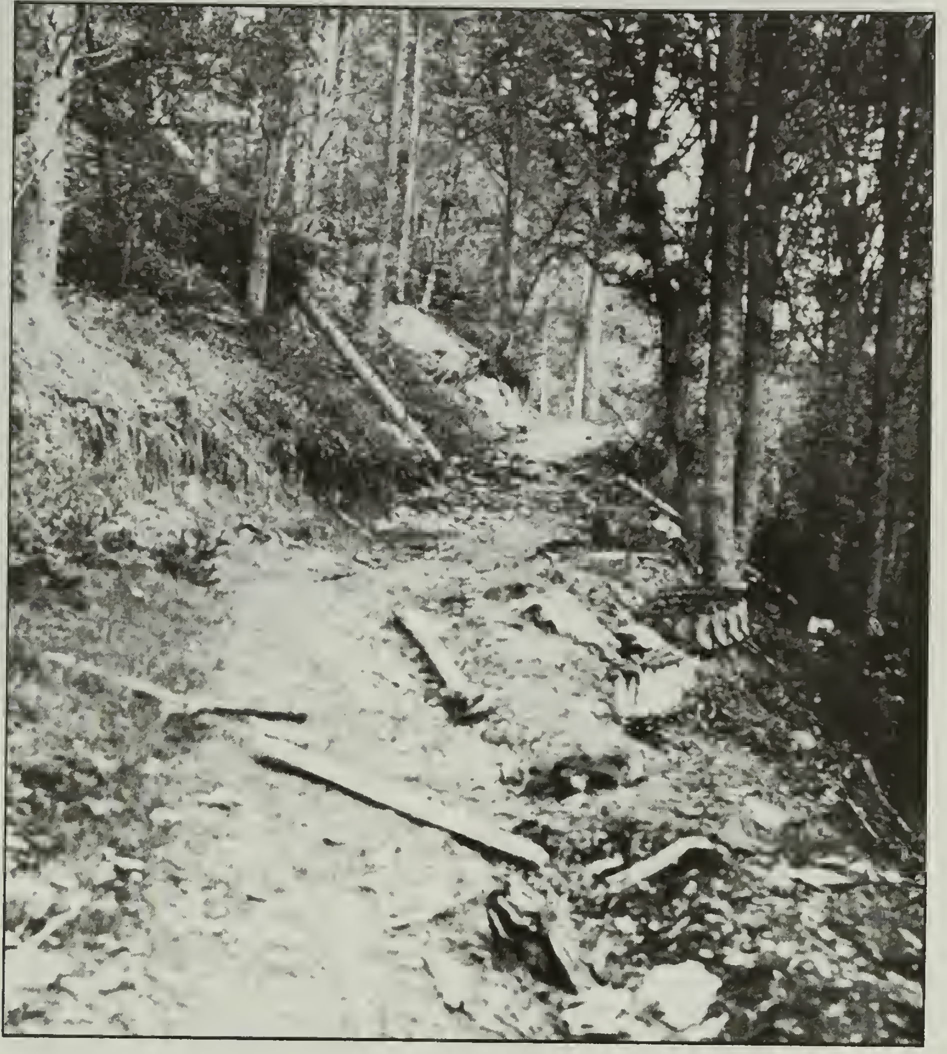
The V Corps commander assigned General Norman D. Cota's 28th Infantry Division to this important objective and allocated many assets to support the attack. A towed antitank battalion added fires to the tank battalion and tank destroyer battalion that were normally attached to the division. The bulk of V Corps' artillery and the entire 1171st Engineer Combat Group supported the division in this operation.

The "Keystone Division," named to reflect its Pennsylvania National Guard origins, needed all the help it could get. In addition to fighting a resolute enemy, it had to contend with very difficult weather and abominable terrain. The weather was wet and cold, though temperatures generally remained above freezing in early November. Constant rains soaked the ground, and roads quickly became quagmires under almost any traffic. The clouds and low ceilings associated with the rain grounded the U.S. aircraft charged with isolating the Schmidt battlefield from German reserves.[2]

The terrain was perhaps more hostile than the weather because the steep-sided valley of the Kall River was between the 28th Division and the objective. This gorge was more than 1,000 meters wide and about 150 meters deep. The sides were thickly forested, and only one cart track offered potential for armored or supply vehicles to cross. Charles MacDonald, author of two official histories of this attack, assessed the situation: "General Cota could only hope that the cart track across the Kall, which had to serve as a main supply route, would prove negotiable: on aerial photographs, parts of the track did not show up."[3]

Although the trail and the bridge across the Kall River were vital to the operation's success, the 28th did little to ascertain their condition. The 28th relieved the 9th Division on October 26 and planned to attack on October 31. They later postponed this attack until November 2, which allowed time for intelligence collection. The 1171st Group tasked the 20th Engineer Battalion to provide three reconnaissance teams. The 3rd Battalion, 112th Infantry, had an experienced patrol led by the S-2, 1LT Greene; they were known as the "Greene Hornets."

Though assets for reconnaissance were available, little patrolling occurred because of the enemy's presence and the forbidding terrain.[4] After the attacking infantry passed through the gorge on November 3, sketchy and incorrect information about the condition of the trail and bridge was passed back to decision makers. As the 3rd Battalion dislodged German defenders from Schmidt, the Greene Hornets guarded the battalion's flank north of the gorge and never traversed the treacherous trail.



Kall Trail supply route between Vossnack and Kommersheidt on the Vossnack side of the gorge. Thrown tank tracks litter the trail.

Because conditions in the gorge were unknown to the leaders who could focus the engineer effort, the trail remained a bottleneck throughout the operation. The 20th Engineer Battalion's primary mission was to clear the trail, and Companies A and B were assigned this task. Although mobility efforts on the trail started after nightfall on November 3, only three engineer platoons worked on it during the night. These soldiers worked with hand tools until a bulldozer arrived in the middle of the night. The dozer broke down after working for about an hour. The 20th Engineers employed no other assets until after noon on November 4, when General Cota personally ordered the 1171st Group commander to send "a competent officer" to take charge of the trail-clearing operation.[5]

The engineer effort at the gorge was clearly too little and too late to relieve the bottleneck. Three small tracked vehicles, called weasels, carried supplies to Schmidt during the night on November 3, and three tanks traversed the gorge with great difficulty the morning of November 4.

This support was also too little and too late because the Germans counterattacked that morning. Their tank and infantry forces drove the Americans out of Schmidt, although the battle continued for several more days. Some additional vehicles traversed the difficult Kall Gorge,

The M29 cargo carrier (weasel) was the first vehicle to traverse the Kall Gorge and support the 28th Division's attack.

but the 20th Engineers never made it an acceptable supply and reinforcement route. Disabled tanks from the first abortive attempts to force the passage blocked the trail.

Had General Cota been provided accurate information concerning conditions in the Kall Gorge, he could have devised a plan to overcome the obstacle. The most crucial engineer asset at his disposal was a command structure to oversee mobility efforts on the trail and ensure that resources were prepared to work as soon as the area was secured. However, the absence of terrain intelligence hobbled General Cota's operation from the beginning. As a result, the Kall Gorge cost the Keystone Division success at Schmidt.

Operation Flashpoint

U.S. Army planning for Rhine River crossings in the spring of 1945 reflected costly experiences such as the Battle of Schmidt. In contrast to the 28th Infantry Division's operation, the 79th Infantry Division conducted extensive reconnaissance before Operation Flashpoint—the crossing of the Rhine.

Extensive terrain reconnaissance was a vital part of the preparation for Operation Flashpoint. During planning stages, the corps engineer merged the S-2 sections of the supporting 1148th and 1153rd Engineer Combat Groups. These staff sections coordinated an intelligence collection effort and performed their own reconnaissance to determine detailed information about the crossing area and the river. They determined soil trafficability and located potential bridging, rafting, and assault sites. All sites were further reconnoitered by infantry commanders accompanied by engineer leaders down to the platoon level. During the actual assault operation on March 24, divisional engineers crossed in the first wave and reconnoitered routes of advance and minefields. They found weak spots in the German obstacles on the far shore.

> **"During the actual assault...divisional engineers crossed in the first wave and reconnoitered routes of advance and minefields."**

Operation Flashpoint was a walkover because there was little enemy resistance. However, extensive terrain intelligence enabled the 79th to accomplish detailed planning and rehearsals vital to heavily opposed crossings.[6]

Other Campaigns

Combat engineers in the European and Mediterranean Theaters of World War II frequently conducted terrain reconnaissance and evaluation missions. In some cases, engineers augmented maneuver forces during reconnaissance operations. In the final analysis, even though "There was initially a marked reluctance to permit engineers to collect their own intelligence and put it in a form suitable for use by engineers,"[7] engineers did contribute to intelligence collection efforts throughout the European Campaign.

During World War II, the U.S. Army organized and equipped the combat engineer battalions much like today's wheeled corps combat battalions. The nondivisional combat battalion was identical to its counterpart in the infantry division. These units had organic reconnaissance sections,[8] as did the armored engineer battalions in armored divisions.[9]

The headquarters and headquarters company of the engineer combat group also had a reconnaissance section. Doctrine charged the group S2 to be a combined collection planner, intelligence agency, and liaison with division G2s.[10]

Just as the organizational structure provided for the reconnaissance mission, doctrine and training heavily favored engineer reconnaissance. Every mission outlined for combat engineers in FM 5-6, *Engineer Field Manual: Operations of Engineer Field Units,* placed reconnaissance as the first step. This manual devoted an entire chapter to reconnaissance, outlined sources of terrain information, and defined engineer reconnaissance as "searching for engineer information regarding topography, resources, and enemy installations and activities affecting engineer operations."[11] FM 5-5, *Engineer Field Manual: Engineer Troops,* indicated that engineer headquarters' S2s at all echelons were responsible for the collection plan, gathering and evaluating engineer information, and supervising reconnaissance training.[12] Outside the engineer community's doctrine, combat engineers were clearly expected to make a contribution, as indicated by FM 100-5, *Field Service Regulations: Operations:* "Small engineer groups should constitute a portion of ground reconnaissance units to obtain and report information concerning routes of communication and movement, demolitions, land mines, and obstructions."[13]

The Cost

History shows that combat engineers were organized, trained, and employed for reconnaissance during World War II. The efforts of the engineer S-2s were sometimes duplicated by their maneuver counterparts or information was not shared soon enough, but the system established by doctrine produced the necessary information most of the time. Nevertheless, the European Campaign provided an example of the tragic cost of inadequate terrain intelligence—the Battle of Schmidt.

Major Bayles serves as XO, 1st Armored Division Engineer Brigade, Bad Kreuznach, Germany. Previous positions include commander of the 84th Engineer Company. He is a graduate of the Command and General Staff College and of the the School of Advanced Military Studies and holds master's degrees from Rensselaer Polytechnic Institute. He is a registered professional engineer in New Hampshire.

Endnotes

[1] MacDonald, Charles B., and Mathews, Sidney T., *Three Battles: Arnaville, Altuzzo, and Schmidt*, Center for Military History, Washington, D.C., 1952, p. 251.

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[3] Ibid.

[4] MacDonald. *Three Battles...* p. 255.

[5] Ibid. p. 313.

[6] *Rhine Crossing by the 79th Division,* 24 March 1945, Headquarters, 79th Infantry Division.

[7] Final Report of the Chief Engineer, European Theater of Operations. 1942-45., Headquarters, European Theater, p. 90.

[8] FM 5-5, *Engineer Field Manual: Engineer Troops,* Washington, D.C., War Department, 11 October 1943, p. 53-54.

[9] Forty, George, U.S. Army Handbook, 1939-1945, 1979: Charles Scribner's Sons, p. 64.

[10] FM 5-5, p. 4.

[11] FM 5-6, *Engineer Field Manual: Operations of Engineer Field Units*, Washington, D.C., War Department, 23 April 1943, p. 25.

[12] FM 5-5, p. 13.

[13] FM 100-5, *Field Service Regulations: Operations*, Washington, D.C., War Department, 15 June 1944, p. 52.

U.S. Army Engineer School

Directorate of Training

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Technical Director	**Mr. Holtz**		**-6295**
Program Management Division	**LTC Iiams**	**ATSE-T-PD**	**-7727**
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Department of Tactics & Leadership	**LTC Wetherell**	**ATSE-T-TL**	**-5683**
Technical Director	Mr. Dunstedter		-5683
Tactics Division	MAJ Burns	-T	-5729
Marine Corps LO	LTC Drury	-A	-5461
Air Force LO	LTC Kunzli	-L	-5195
EOAC Division	MAJ McCall	-TD	-5742
Leadership & Environmental Branch	MAJ Neeley		-5657
Training Development	CPT Cromby		-5649
Department of Construction Engineering	**LTC Boothe**	**ATSE-T-CTE**	**-7456**
Technical Director	Ms. Welch		-7797
Vertical Skills Division	CPT Goetz	-VS	-5440
Maintenance Division	MAJ Page	-MT	-7784
Horizontal Skills Division	CPT Kuehl	-HS	-7787
Training Development	Mr. Tapp	-TD	-7505
Department of Combat Engineering	**MAJ Jones**	**ATSE-T-CE**	**-5800**
Technical Director	Mr. Jackson		-5501
Combat Engineering Division	MAJ Jones		-5803
Bridging Division	CPT Carey	-B	-5521
CEV Division	CPT Hauert	-V	-5810
Training Development	vacant	-T	-6214

ENGINEER UPDATE

Commercial numbers are (314) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Directorate Consolidation. The Directorate of Training (DOT) was established on June 4, 1993 at the Engineer School. Combining teaching, writing, and doctrine development in a synergistic relationship, the DOT is responsible for all training development functions and engineer training, from AIT through the Pre-Command Course. Included in the new organization are the former Deputy Assistant Commandant office, Directorate of Training and Doctrine, Department of Instruction, and some functions previously managed by the 1st and 3rd Brigades. A partial directory and phone list appears on page 54. POC is Cynthia Mathews, -6343.

Field Manual (FM) 5-71-100 Distributed. FM 5-71-100, *Division Engineer Combat Operations,* was distributed in April. It describes the principles, engineer tactics, techniques and procedures used to guide the conduct of engineer operations that support the division. POC is Joe Sillyman, -7532.

Change 1 to FM 90-13-1 Published. Change 1, dated 7 May 1993, adds two appendices to FM 90-13-1: Appendix D, *Breaching Rehearsals,* and Appendix E, *Breach Lane Marking.* FM 90-13-1 is bound with staples; to update it, remove the old pages and insert the pages in Change 1. POC is Joe Sillyman, -7532.

Directorate of Combat Developments (DCD)

Mine Clearing Line Charge (MICLIC) Update. As of 16 July 1993, the MICLIC launcher and trainer are reportable as a system on unit status reports. A future edition of AR 700-138, *Army Logistics Readiness and Sustainability,* will reflect this change.

Three recent system improvements have increased the reliability of the Army's MICLIC: installation of an arming wire weave, correction of slack in the detonating cord between the fuse connector and the first block of C4, and correction in the orientation of the rocket motor receptacles with the arming wire weave.

NOTE: Prior to acceptance, units must check the NSN and ammunition code of rockets and line charges. The Army's assets of line charges are M58A4/5, NSN 1375-01-237-5933/1375-01-302-0527, ammunition code M913. The Army only has MK22 MOD4 rockets, NSN 1340-01-118-2838, ammunition code J143. The Marine Corps still has line charges without the system improvements (described above) and MOD3 rockets. Some Army units have been issued Marine Corps assets (line charges without modifications and MOD3 rockets); these should be returned to the appropriate supply activity. POC is CPT LeRoy Maurer, -7347.

Armored Vehicle Launched MICLIC (AVLM). The current AVLM is not an Army fielded system, and it should not be used in peace time. Tactical Army Command (TACOM) has agreed to design, build, and test a prototype mounting bracket for an AVLM system. The Engineer School's goal is to field a standardized, safe, and tested mounting bracket in the near future. POC is CPT LeRoy Maurer, -7347.

Directorate of Evaluation and Standardization (DOES)

Essential Library Publications for Disaster Relief. Because any engineer unit may find itself responding to a humanitarian assistance mission or deployed for disaster relief, all units must maintain and deploy with a select library of essential construction management and planning references. This applies to all combat, combat heavy, and corps combat battalions, and to all construction support and combat support equipment companies. We recommend (at a minimum) the following publications:

- TM 300-series AFCS Manuals (in the battalion S-3 or company headquarters)
- FM 5-233, *Construction Surveying*
- FM 5-333, *Construction Management*
- FM 5-420, *Plumbing/Pipefitting for Water Supply/Distribution Systems*
- FM 5-421, *Sewerage*
- FM 5-424, *Interior Wiring*
- FM 5-480 *Port Construction and Repair*
- FM 5-551, *Carpentry*
- FM 5-742, *Concrete*
- TC 5-340, *Air Base Damage Repair (Pavement Repair)*
- *National Electrical Code* (commercial)
- McMaster/Carr Industrial Supply Catalogue (commercial)
- W.W. Granger Industrial Supply Catalogue (commercial)
- *The Lineman's & Cableman's Handbook,* Kurtz and Shoemaker, 7th edition, McGraw-Hill Book Co., ISBN 0-07 035686-6 (commercial)

POC is Vern Lowrey, -5304.

Engineer Branch Safety Office (EBSO)

Truck/semitrailer Accidents. Two soldiers were killed recently in an accident involving an M920 truck tractor and an M870, 40-ton lowbed semitrailer. After the accident investigation, TACOM issued three Safety of Use Messages (SOUM). SOUM 93-03 and 93-08 provide procedures for recurring brake adjustments for the M870 and M870A1 40-ton lowbed semitrailers. SOUM 93-06 describes a modification work order (MWO) for an auxiliary air tank on the M915-series of vehicles. Engineer units must have these SOUMS and comply with their instructions. POC is Paul Rusinko, -5008.

News and Notes

1992-93 Military History Writing Contest. Students attending officer advanced courses and the Sergeants Major Academy during calendar years 1992 and 1993 are encouraged to enter the Military History Writing Contest. Sponsored by the U.S. Army Center of Military History, the contest is designed to improve communication skills and enhance knowledge of the profession of arms. Winners receive cash awards and DA certificates of achievement. Manuscripts must be unpublished, with a maximum length of 3,500 words, and must be postmarked by midnight 31 December 1993. For contest rules and more information, call Billy Arthur, at (202) 504-5368, DSN 285-5368.

BRIDGE THE GAP

By Command Sergeant Major Roy L. Burns, Jr.
U.S. Army Engineer School

Just completed 33 days of temporary duty at Fort Benjamin Harrison, as a voting member for the Master Sergeants' Board. I was assigned to a panel made up of one colonel (armor), one lieutenant colonel (engineer), and three command sergeants major. I now realize that many noncommissioned officers (NCOs) need to update their personnel qualification records (PQRs) if they wish to remain competitive for future training and promotions. Let me expand on what I learned.

Our panel was given 10 days to vote 2000 files of armor and engineer sergeants first class, in the primary and secondary zones, to the rank of master sergeant. We spent an average of 8 minutes on each file; less time was used for those records that clearly were in great shape.

Records. The short review time means that PQRs must be clear, concise, and above all, up-to-date. Commanders and command sergeants major must establish a system to ensure that all soldiers eligible for promotion review their files. Commands are notified 120 days before the board convenes, and they are given two suspenses for submitting PQR, and current DA photographs to the Enlisted Records Evaluation Command, at Fort Benjamin Harrison.

The first record I voted had critical flaws. The DA photo, taken in 1980, showed the rank of staff sergeant on the uniform. The soldier had not signed the DA Forms 2A or 2-1 (PQR), and the latest duty assignment did not match the assignment on the forms. The file contained a one-half inch thick packet that had been mailed to the board. It was unnecessary because most of the documents in it were posted on the individual's microfiche and/or the DA Form 2-1. Incredibly, it did not contain an updated photo. The mailing of this packet indicated that the individual's microfiche had not been reviewed at the duty station. Needless to say, that soldier was not highly competitive!

NCOERs. Overall, many of the principal duty titles I reviewed did not match the duty MOS, Parts III(A) and (B). For example, Part III(A) might show, combat construction foreman and Part III(B) incorrectly show 12B40 instead of 12Z50.

Senior raters' comments (Parts V, C and E) weigh heavily in the selection process. These comments must focus on an individual's potential and make concrete recommendations for promotion, schooling, and the likelihood of future success. Senior raters who do not perform this task adequately may hinder their soldiers' promotions.

Training and Education. I am pleased that all NCOs had completed the Advanced Noncommissioned Officer Course, and most serving in first sergeant positions had attended the first sergeants' course. Commanders must also ensure that soldiers serving in operations or intelligence staff positions have attended the battle staff course. Files I reviewed indicated some NCOs lacked this training.

Many records showed little correlation between training and subsequent duty assignments. Some NCOs are in positions without prerequisite training, and some who received training are not in positions to utilize it. This creates a perception of "ticket punching," which we must change. We also must emphasize the need for self-development (college) courses. Some good files I reviewed were marred by a lack of civilian education beyond a high school diploma or general education development (GED).

Utilization and Assignments. The most competitive individuals had a healthy mix of TOE and TDA assignments. CMF 12 soldiers exhibited an excellent pattern of rotating through key duty assignments—their files documented considerable time in challenging assignments.

Secondary Zone NCOs. Interestingly, I felt this group of NCOs were as qualified as and had a higher civilian education level than those in the primary zone. However, platoon sergeant time was critical; NCOs need 18 months or more to be competitive.

Bottom Line. The most competitive NCOs had a good mix of challenging leadership assignments, good performance in those assignments, and they exceeded standards for military and civilian education. To be a leader in tomorrow's Army, you must seek the tough jobs, do well, and actively pursue educational opportunities.

Army leaders are responsible for their soldiers' development; they are the future. Leaders and subordinates must use two documents published by the Engineer School: a "Career Professional Development Program" and "NCO Leader Self-development Career Maps" (updated career maps are on pages 40-41). These tools are in the system to promote growth and professionalism. Let's use them.

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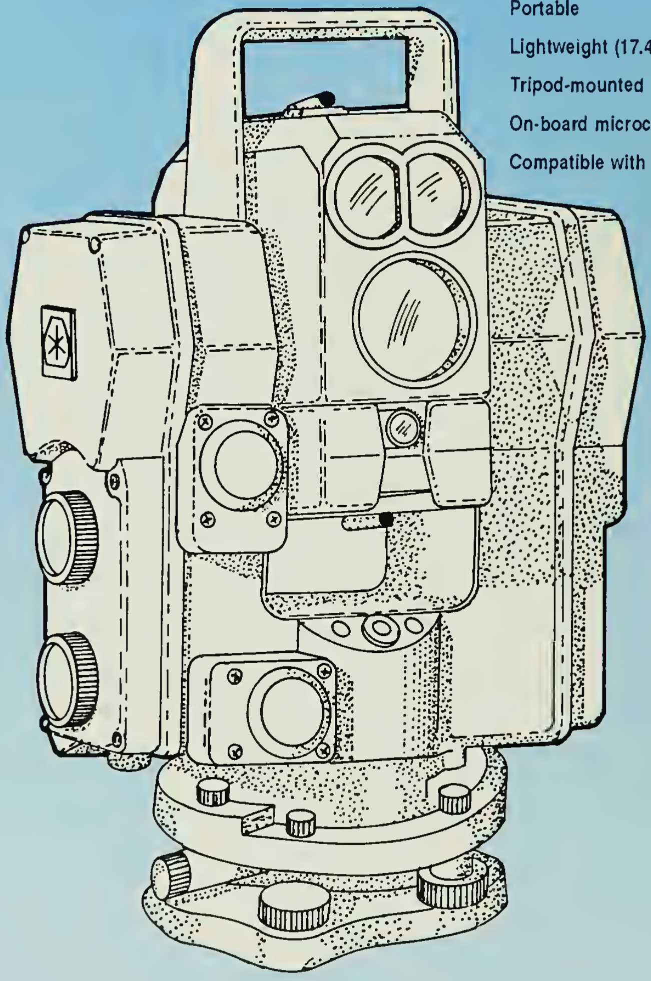

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